Applied Hydraulics

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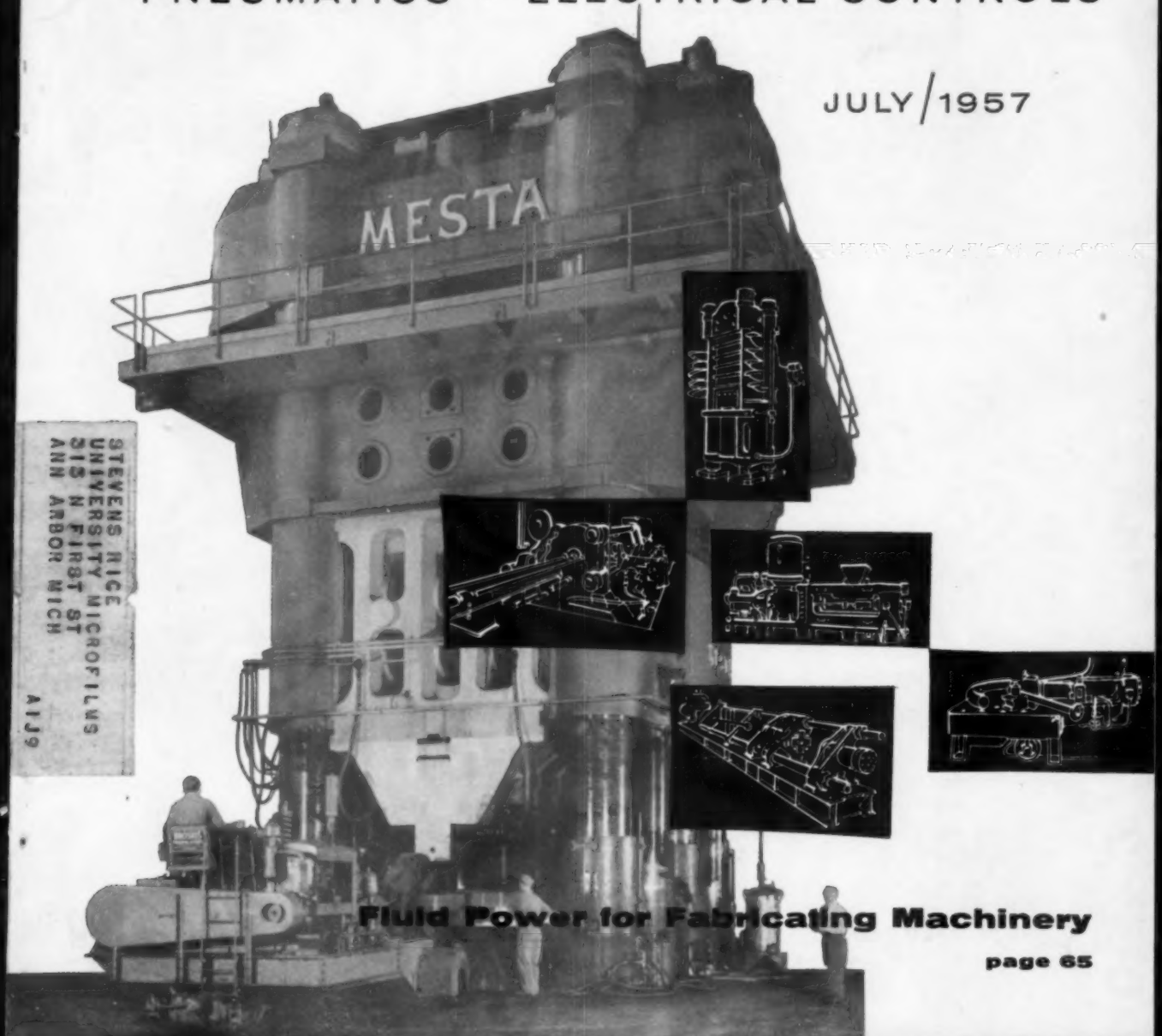
JULY/1957



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Fluid Power for Fabricating Machinery

page 65

THE MAGAZINE OF FLUID POWER

AN INDUSTRIAL PUBLISHING CORPORATION MAGAZINE

Now in Preparation

1958/59 FLUID POWER DIRECTORY

For complete details, see pages 24-25

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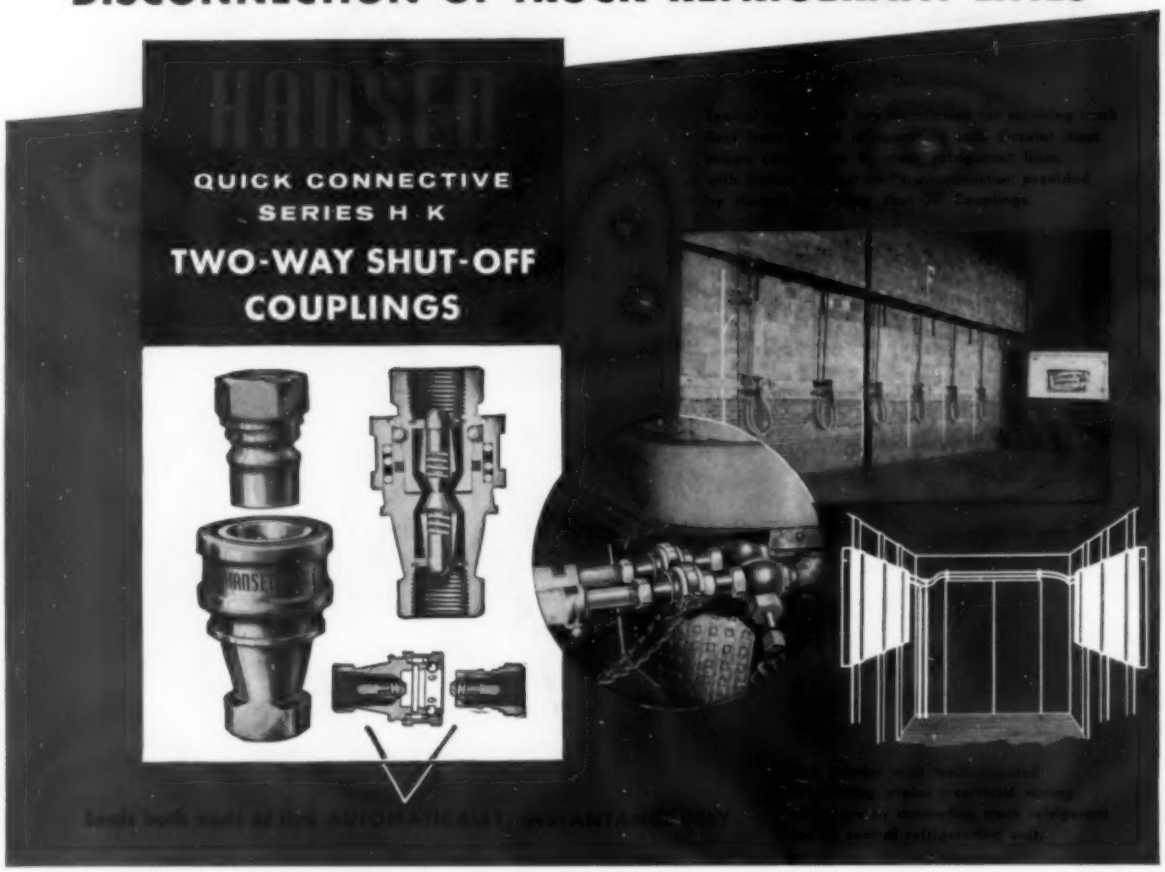
TO PROVIDE INSTANT CONNECTION AND DISCONNECTION OF TRUCK REFRIGERANT LINES



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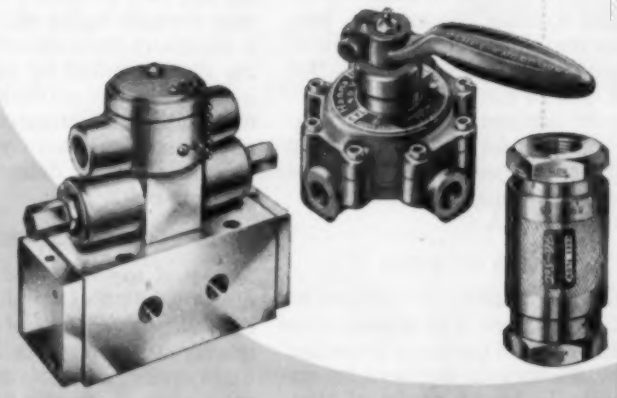

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- A plant engineering staff that backs a nationwide regional engineering-sales organization to help you quickly solve difficult problems—and to follow through on all your "needed now" requirements. Many Hanna Representatives stock the standard sizes and types of Hanna Products—the Hanna Plant, of course, does, too.

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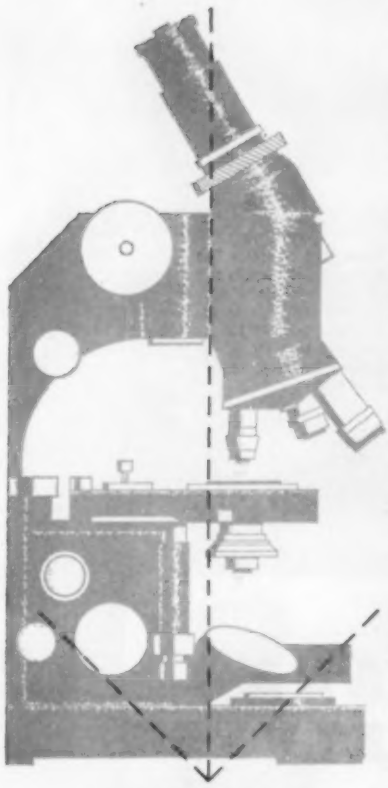
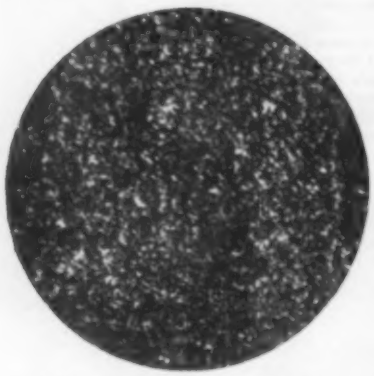
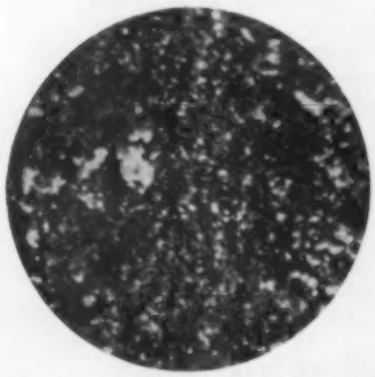
how injection molding can help you solve design problems and improve products that require rubber parts . . .





Modern injection molded rubber.



Standard compression molding.

Greater density produced by injection molding of rubber is shown in comparison to ordinary compression molding. Injection molded rubber (top) displays homogeneous characteristics unequalled for consistency or toughness by any other process. In application, this will mean tremendous resistance to abrasion and chemical action—much longer life for rubber parts. Both microphotographs are standard Buna N compound, approx. .269″ x .019″, magnified 240 diameters by the University of Minnesota.

The unequalled high density that results from *injection molding* of organic, synthetic, and silicone rubber compounds offers the key to optimum performance from rubber parts. Minnesota Rubber and Gasket Company uses an exclusive injection molding process that provides matchless product consistency and tolerances as close as .002 inch, all on a mass production scale. Custom compounding and laboratory facilities for research, problem analysis and product development are among the many additional services offered you.

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Applied Hydraulics

Volume 10/Number 7

JULY 1957 THE MAGAZINE OF FLUID POWER

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Reprinted from Applied Hydraulics April 1956—page 74

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Applied Hydraulics

THE MAGAZINE OF FLUID POWER

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Useful Literature

NEW ANCHOR FLANCO CATALOG ANNOUNCED

A new Anchor Catalog, No. 401, has just been issued that covers Anchor patented FLANCO Hydraulic Hose Assemblies for use with the Anchor FLANCO 4-Bolt, Split-Flange "O"-Ring Head Couplings.

This patented "O"-Ring Head coupling incorporates a leak-proof "O"-Ring seal that eliminates the need for pipe threading, gaskets and sealing compounds. With it connections can be made to valve and pump bosses without wedging by tapered threads. Hose lines can be disconnected and reconnected time after time without leaks because there are no threads to wear out or tapered seats to groove. No special tools are required to connect the FLANCO 4-Bolt, Split-Flange "O"-Ring Head Coupling, -just small automotive type wrenches. Hose assemblies are available for use with this "O"-Ring Head Coupling in Pressed-On or Reusable Clamp types for high, medium and low pressure service in sizes ranging from ½" to 3" I.D.

First announced in this catalog is a new Pressed-On swivel coupling that offers new freedom in design, positioning and installing of hose assemblies. With the 360° swiveling permitted, twisting and straining of the hose is eliminated since it is free to swivel to any desired position.

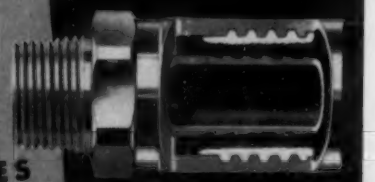
The new swivel coupling is available in all sizes from ½" through 2" I.D. for Two-Wire Braid Hose.

Anchor Pressed On Hose Assemblies for FLANCO 4-Bolt, Split-Flange "O"-Ring Head Couplings are available for high pressure applications in Two-Wire Braid Hose from ½" to 2" I.D., with straight, 22½°, 30°, 45°, 60°, 67½° and 90° couplings. Spiral Wire Suction Hose assemblies are available from ¾" to 2-½" I.D. in the same range of angles. Hose assemblies with Clamp-Type Reusable Couplings are available for ½" to 2" I.D. High Pressure, Two-Wire Braid Hose—½" to 2" I.D. One-Wire Braid Hose—¾" to 3" I.D. Spiral Wire Suction Hose,—½" to 1-¼" I.D. Medium Pressure HI-BURST 2-Rayon Braid Hose and ½" to ¾" I.D. Low Pressure 2-Rayon Braid Hose, all with coupling stems from 0° to 90° in all standard angles.

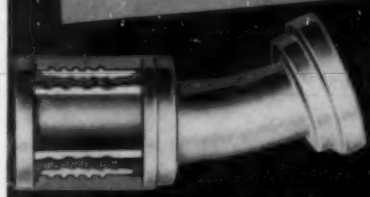
Maximum flexibility and convenience are provided with either the Pressed-On or Clamp-Type Reusable Couplings.

Write for Catalog No. 401 to Anchor Coupling Co., Inc., 323 N. Fourth St., Libertyville, Ill.

This Inside Story tells you why ANCHOR® HOSE ASSEMBLIES Meet Your Most Rigid Requirements



ANCHOR HIGH PRESSURE DUCTILE SLEEVE COUPLING TWO WIRE BRAID HOSE ASSEMBLY



ANCHOR FLANCO BENT STEM 22½ HIGH PRESSURE TWO WIRE BRAID HOSE ASSEMBLY (30°, 45°, 60°, 67½° and 90° also available)

When we speak of "inside story" in this case, we primarily refer to the cross-sectional views shown which obviously confirm both design and construction advantages built into all Anchor Hose Assemblies.

But, further and beyond these obvious benefits, we also refer to the intangible advantages evolving from years of experience in the designing and manufacturing of Hydraulic Hose Assemblies—advantages that can only be verified by actual usage—advantages that do not show up until you reach those bonus months of dependable service, which all users of Anchor Assemblies KNOW about and keep coming back for, order-after-order.

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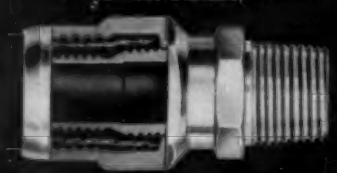

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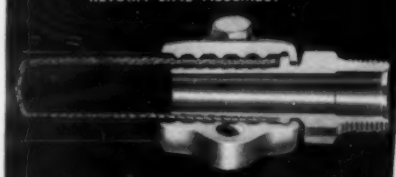

ANCHOR CLAMP TYPE REUSABLE COUPLING USED ON TWO WIRE BRAID HIGH PRESSURE HOSE

Andy Anchor Says:

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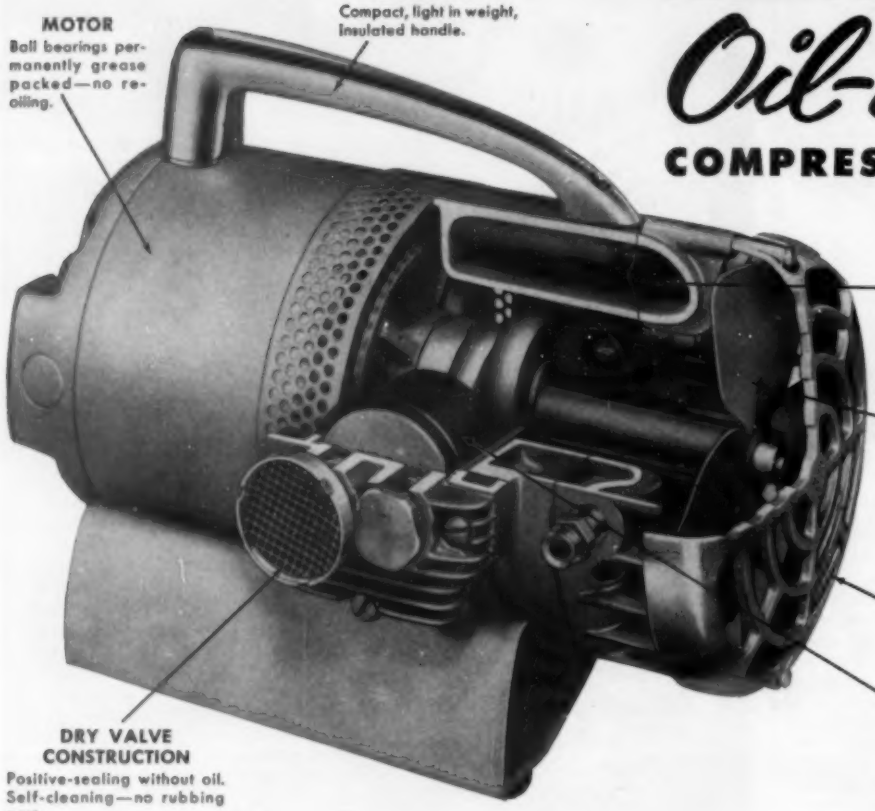
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For complete information on B&G Oil-less Compressors and Vacuum Pumps, send for Catalog GO-1156.

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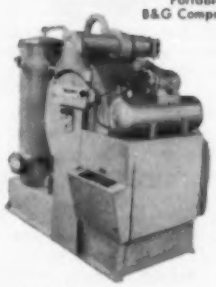

B&G Oil-less Air Compressor as integral part of dry cleaning machine

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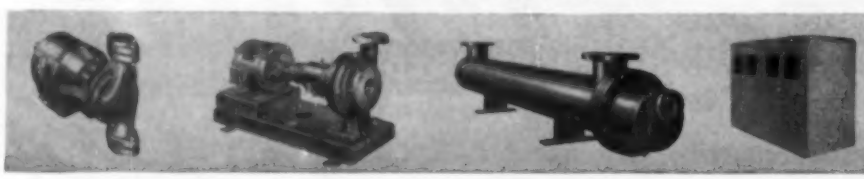

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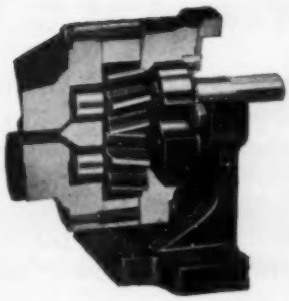

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Fluid Power Lines

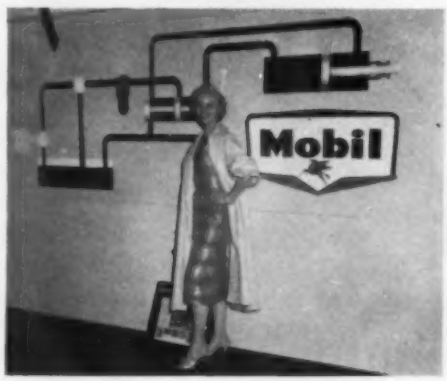
about Applied Hydraulics

PROBLEMS, PROBLEMS . . . If there were no problems in designing and using machines, there would be no progress either. This was evident at the recent Vickers Conference on Fabricating Machines—presses, welding machines, and benders—where machine builders, component suppliers, and users had the opportunity to sit down together to discuss their common problems, and incidentally create a few more for the future. Users would like machines that require no servicing. Manufacturers would like versatile components that could be used at several hundred percent over their rating. Somewhere in between there's a practical compromise which can only be reached by open discussion.

Many stimulating ideas were tossed about at the meeting, like the use of stainless steel reservoirs to eliminate corrosion, and a temperature-compensated flow control valve to maintain accurate feeds. Not *all* of the ideas will work for *all* applications, but certainly they will start a lot of people thinking about new solutions to old problems.

BEND AN EAR . . . The people at Wallace Supplies are mighty proud of their bending machines, and rightly so. They've used hydraulics since 1935, not only for its high force, but also for the smooth control that's important in precision bending. The illustrations on page 70 show how far they've come from the early models to the recent aircraft benders.

FLUID POWER CURVES . . .



A pretty girl can make almost anything more interesting, including a fluid power circuit. We snapped this one at the Cleveland Coal Show reported in *Briefs*. Vital statistics: f:11 at 1/200th.

SYNCHRONIZING . . . Two methods for synchronizing cylinders are detailed in this issue. Synchronizing with coupled fluid motors is presented in the article by John Perkon, who describes his die casting machine design which uses a cylinder actuated wedge to lock the platen. The design considerations in using series connected cylinders are outlined in the aircraft article. Which method is selected of course depends on the application. Both can be very effective.

BUMPS AND GRINDS . . . Unlike burlesque, central systems are not dying. They're very practical for installations where batteries of machines are operated. In manufacturing grinding wheels, Norton Co. found it necessary to analyze their system long in operation, and to add pumping capacity to accommodate increased production. *Boosting Central System Capacity* tells the story.

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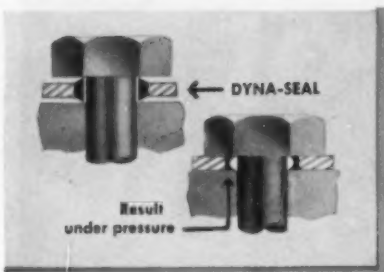
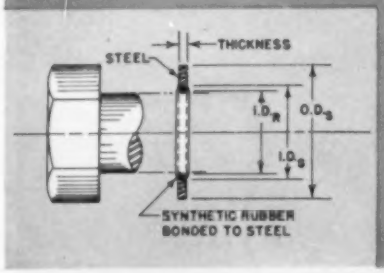
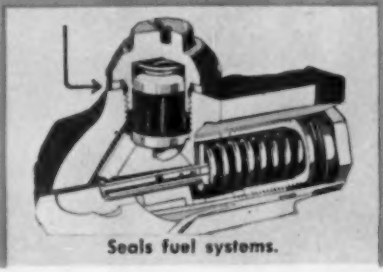


Seals hydraulic control manifold.

Seals relief valve.




Seals fuel systems.

Seals aircraft fittings.

Easy-to-handle one piece seal of rubber bonded to a steel washer.

- No special machining required.
- Reduces assembly costs.
- Positive sealing up to 10,000 P.S.I.
- Vibration proof, lock washer action.
- Reduces bolting torque.
- Reusable—cuts maintenance.

Available in-stock sizes for No. 5 screw to 1¼" bolt or from ⅛" to 1¼".

Let a Precision engineer demonstrate the Dyna-seal cost and labor saving advantages to you. Write today!

PRECISION PART NO.	BOLT SIZE (MAX. O.D.)	I.D.S ±.003	O.D.S ±.003	I.D.R +.000, −.004	THICKNESS ±.0025
110-5	.125	.195	.315	.145	.041
110-6	.138	.208	.328	.158	.041
110-8	.164	.234	.364	.184	.041
110-3/16	.190	.281	.422	.220	.054
110-7/32	.216	.307	.453	.246	.054
110-1/4	.250	.341	.516	.280	.054
110-5/16	.312	.403	.594	.342	.054
110-3/8	.375	.466	.687	.405	.054
110-7/16	.437	.528	.766	.467	.075
110-1/2	.500	.601	.875	.540	.075
110-9/16	.562	.663	.969	.602	.075
110-5/8	.625	.726	1.062	.665	.075
110-11/16	.687	.788	1.156	.727	.090
110-3/4	.750	.865	1.266	.800	.090
110-13/16	.812	.927	1.359	.862	.090
110-7/8	.875	.990	1.453	.925	.090
110-15/16	.937	1.052	1.531	.987	.090
110-1	1.000	1.135	1.656	1.050	.090
110-1 1/8	1.125	1.260	1.844	1.175	.090
110-1 1/4	1.250	1.385	2.016	1.300	.134

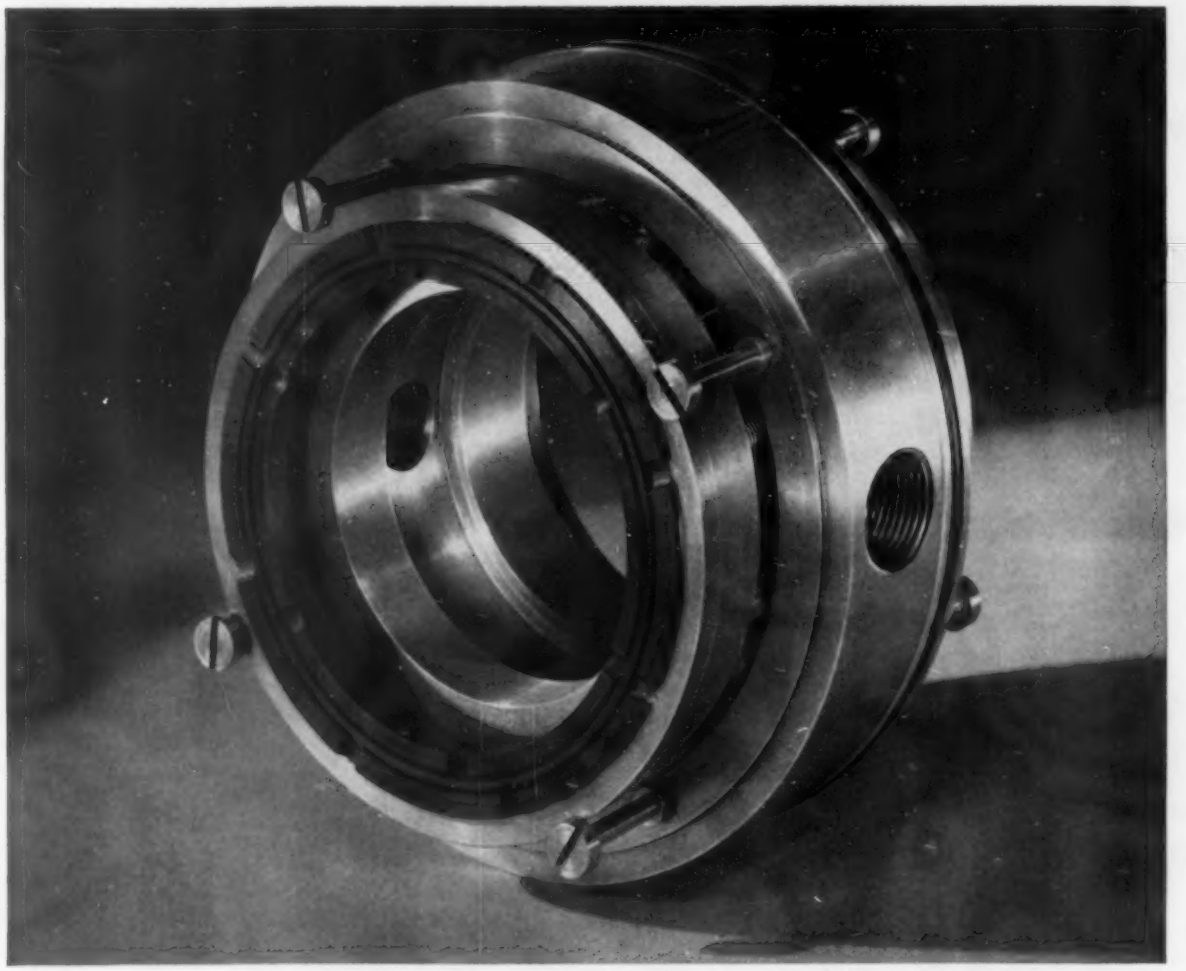
Write for your free copy of the Precision catalog on Dyna-seals.

Precision Rubber Products Corporation

"O" Ring and Dyna-seal Specialists

Dept. 1, Oakridge Drive, Dayton 7, Ohio

Canadian plant at: Ste. Thérése de Blainville, Québec



Koppers Face Type Seal Provides Up to 20,000 Hours of Service!

Up to 30,000 Hours in Laboratory Tests Using Clean Gas!

Koppers engineering has created an unmatched sealing surface that gives Koppers Face Type Seals a much longer-than-ordinary service life.

The exclusive design of the sealing surface keeps pressure distribution and hydraulic balance unchanged during operation . . . permits a light face loading which lowers interface temperatures. Hydraulic balance allows sealing of gases and liquids through a wide range of rubbing speeds. Rugged construction adds to Koppers long service life. Rotating collars can be of hardenable stainless steels, cutlery and die steels, Stellites, or of a hard chromium or carbide face. Ring is of carefully selected grades of carbon.

If you have a sealing or piston ring problem, Koppers entire research, production and engineering facilities are at your disposal. For more details, write to the KOPPERS COMPANY, INC., 1507 Hamburg St., Baltimore 3, Maryland.

Koppers Company, Inc.
Metal Products Division
Piston Ring and Seal Dept.

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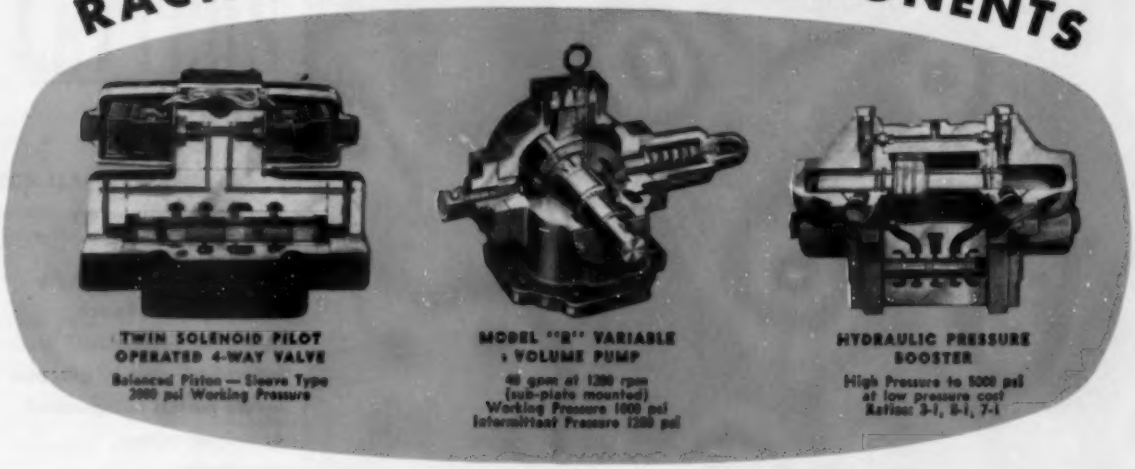
Sold with *Service*

KOPPERS

MECHANICAL
SHAFT SEALS

Circle 77 on Reader Service Card

RACINE HYDRAULIC COMPONENTS



TWIN SOLENOID PILOT OPERATED 4-WAY VALVE
Balanced Piston — Sleeve Type
3000 psi Working Pressure

MODEL "R" VARIABLE VOLUME PUMP
40 gpm at 1200 rpm
(sub-plate mounted)
Working Pressure 1000 psi
Intermittent Pressure 1250 psi

HYDRAULIC PRESSURE BOOSTER
High Pressure to 5000 psi
at low pressure cost
Ratios: 3-1, 5-1, 7-1

Assure installation and operation economies

IMPORTANT TO YOU!

INSTALLATION ECONOMIES — Racine designed and built hydraulic "Power Units" are compact — yet all components are easily accessible for quick servicing. Hook-up to your equipment is fast and simple.

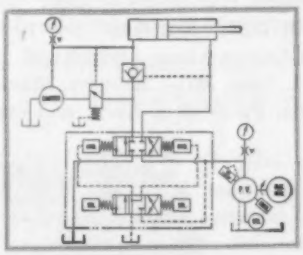
OPERATION ECONOMIES — With Racine Variable Volume Pumps and Boosters, you get high-pressure results at low-pressure cost. *You put all of the oil to work.*

EQUIPMENT ECONOMIES — Racine's unique hydraulic design requires a minimum of components, thus extreme circuit simplification.

TYPICAL RACINE "POWER UNIT" DESIGNED AND BUILT TO YOUR SPECIFIC NEEDS

FREE ENGINEERING SERVICE

Augment your busy, short-handed engineering team by taking advantage of our specialized hydraulic engineering service at *no cost to you.* Write us about your problem — no obligation.



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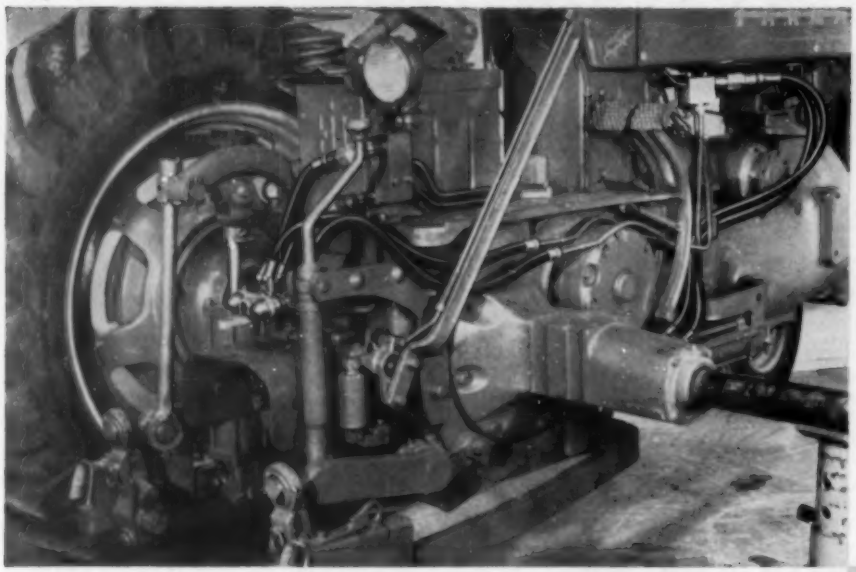

INTERNATIONAL HARVESTER'S
McCORMICK FARMALL 400
Tractor controls every implement action hydraulically through its famous Hydra-Touch hydraulic system. Individual, closely grouped levers permit independent or unison control of cylinders.

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Eastman

HYDRAULIC HOSE ASSEMBLIES . . .

Most competitive Farm Implement Sales Feature

HYDRAULIC POWER probably contributed more to the usefulness, efficiency, and easy operation of farm tractors than any other modern engineering development. Farmers appreciate hydraulic advantages so much that they have become one of the *most competitive features in implement and tractor sales promotion.*

EASTMAN MANUFACTURING COMPANY is proud to have among its many agricultural users the International Harvester Company—dating back to the first McCormick Reaper—in 1831. Eastman—*first in the field* of Hydraulic Hose Assemblies—lists many other agricultural implement manufacturers among its users: J. I. Case, Allis-Chalmers, Massey-Harris-Ferguson, Inc., Minneapolis-Moline, Farmhand, Avco, and others.

IMPROVE THE COMPETITIVE POSITION OF YOUR PRODUCTS with Hydraulic Power—delivered through Eastman Hydraulic Hose Assemblies. Always specify Eastman: First in exclusive engineering advantages and design! First in materials and workmanship! *First in the field* of Hydraulic Hose Assemblies!

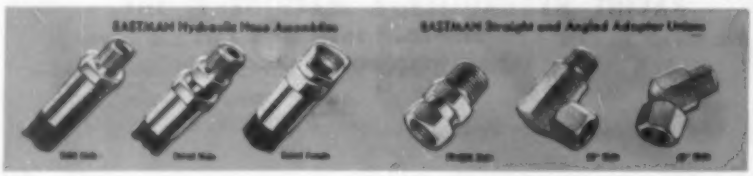
WRITE **Send your specifications and blueprints for our original equipment quotations.**

HYDRAULIC POWER controls plow penetration and depth automatically, lifting and locking in traveling position.

HYDRAULIC POWER controls angle and depth of disc penetration on International Front-Hitch Berb and Bog Harrow.

HYDRAULIC POWER enables Farmall 300 Hydra-Creeper to travel 1/5 to 1 mile per hour for transplanting.

HYDRAULIC POWER permits raising right, left, or rear cultivator gangs separately, together, or any combination.



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first in the field
MANUFACTURING COMPANY
Dept. AH-7, Manitowoc, Wis.

LETTERS to the editor

Address your letters to: Editor, APPLIED HYDRAULICS Magazine, 812 Huron Rd., Cleveland 15, Ohio.

Metal Reed Seals

On page 93 of "Aircraft Hydraulic Design", by George Keller, he refers to metal reed type seals as being commercially available. We are having a problem locating a dynamic seal of this type for our long stroke actuators and would appreciate receiving the addresses of these manufacturers.

LLOYD C. WHITE
Technical Engineer
Control Mechanism Development
General Electric Co.
Cincinnati, Ohio

Information on reed type seals has been forwarded.

Master Catalog

We are interested in securing a copy of the 1956/57 Master Catalog of Fluid Power Products. Please tell us how to get this and the cost.

FRED ROWE,
Manager
Rowe Machine Works
Seattle, Wash.

You can order a copy of the 1956/57 MASTER CATALOG OF FLUID POWER PRODUCTS, directly *from us, at* $6.50.

Flareless Fittings History

Kenneth Clarke's article, "Selection of Flareless Fittings", in your May issue, is technically accurate but historically could leave the impression that MS flareless fittings are a recent development of the Parker Appliance Co. These fittings were introduced in the United States and Canada by The Weatherhead Company under the trade-mark "Ermeto", following their acceptance of a license under the Kreidel patents in 1938. In the early 1940's, the Weatherhead Company brought out the aviation version under the trade-mark "ER" and had the first flareless fittings

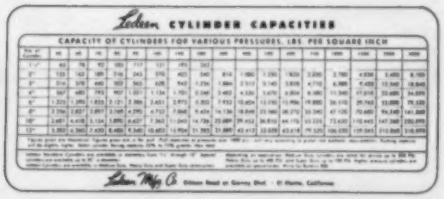
Continued on next page

NEED A CYLINDER?

Ledeen Stocks Them or Builds Them to Fit Almost Any Application

For normal applications requiring standard cylinders or for those unusual applications where a special cylinder is needed, see Ledeen.

Let us know the type of job to be done and how much cylinder power you need. Send for this handy cylinder capacity chart.



Write for Bulletin 500

VALVES • CYLINDERS
VALVE ACTUATORS
AIR-HYDRAULIC PUMPS
AND TEST STANDS

Ledeen Mfg. Co.
3332 North Gilman Road
El Monte, California

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Mr. Plant Engineer–

You're responsible for EFFICIENT air supply to pneumatic equipment

Here are
BRAND NEW
high-efficiency units . . . better air service . . . easier to maintain

Delivers really CLEAN dry air

Watts Filter delivers clean dry air to Federal Products Dimensionair.

High-Efficiency FILTER with exclusive "Tornado Action."

Extreme centrifugal force spirals dirt and moisture particles downward into the "quiet zone" leaving in the air only a minute percentage of the finest and lightest particles which are trapped by the filter cone.

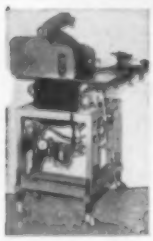
Maintains MORE UNIFORM PRESSURE

Watts Regulator maintains uniform air pressure for Scott-Williams KN Knitting Machine

High-Efficiency REGULATOR with highly sensitive "Aspirator Action."

Watts Aspirator control acts directly on the diaphragm, giving instant compensation for fluctuating pressure demands . . . provides precise control and stabilizes pressures reaching individual pieces of equipment.

LUBRICATES perfectly at all flow rates



Watts Lubricator provides efficient lubrication for Markem Machine Company's Model 70AF.

High-Efficiency LUBRICATOR with exclusive "By-pass pick-up."

Watts new By-Pass Pick-Up makes possible a sub-miniature, high velocity venturi section which positively creates sufficient force — even at flow rates as low as one cubic foot per minute — to vaporize oil into a fine mist for uniform, economical lubrication.

BEFORE YOU MAKE ANY COMMITMENTS —
get the facts on Watts new-design units which open up new worlds of efficiency in Pneumatic Operation, Line Maintenance, and Protection of Equipment against foreign matter.

REQUEST CATALOG AND DETAILED SPECIFICATION SHEETS

WATTS REGULATOR COMPANY
SINCE 1875

8 EMBANKMENT ROAD LAWRENCE, MASSACHUSETTS

LETTERS to the editor

flying on a Martin airplane about 15 years ago.

LOUIS B. COURTOT
Chief Engineer
Special Products Div.
The Weatherhead Company
Cleveland, Ohio

Leakage Control

Your presentation of the leakage control problem in May was excellent. I fully expected the average cursory industrial publication treatment of this most important subject, but was non-plussed by your complete, detailed and thoroughly fair exposition. I am sure that other manufacturers of piping components and devices in this field will share my enthusiasm.

W. W. HUTCHERSON
Gen. Sales Mgr.
Petch Mfg. Co.
Detroit, Mich.

Congratulations on a very interesting issue! I think you have helped many a reader in getting a more comprehensive picture of this leakage problem and how to improve the situation. With the developments such as they have been during the last two years, I feel you have handled the situation very wisely.

BARRETT ROGERS
Gen. Mgr. & Secy.
National Fluid Power Association
Evanston, Ill.

You are certainly to be complimented for the splendid issue of May 1957. You have given the subject involved tremendous coverage. We certainly admire the thoroughness of your work. It is very difficult on such a subject to cover the many facets of leakage control. The issue seems to be a bit weak, however, on extreme temperature and special fluids. These two factors are becoming increasingly important.

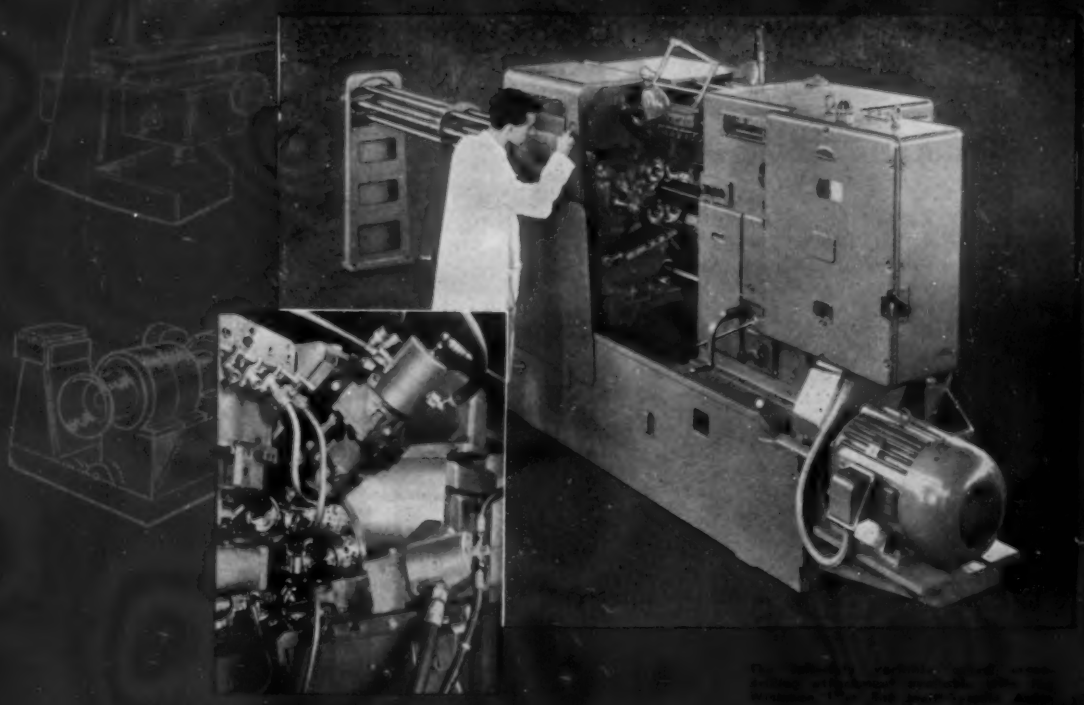
WALTER J. KUDLATY
Asst. Chief Engineer
Miller Fluid Power Div.
Flick-Reedy Corp.
Melrose Park, Ill.

Extreme temperature and special fluids is certainly an important

Continued on page 16

FOR EFFICIENT POWER TRANSMISSION

Keelavite HYDRAULICS



A comprehensive standard range of hydraulic power and control equipment backed by efficient design, installation and after-sales service.

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THE RECOGNISED AUTHORITY ON HYDRAULIC POWER TRANSMISSION

COUPARD HYDRAULIC GAUGES DO THE JOB RIGHT

HERE'S WHY **CARTER** CAN OFFER

IMMEDIATE DELIVERY

ANY BORE SIZE • ANY MOUNT • ANY STROKE

CYLINDERS

AIR OR HYDRAULIC

AIR CYLINDERS

250 LB. HYDRAULIC

CLAMP CYLINDERS

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AIR VALVES

BUILT-IN VALVE TYPES

- **100% EXPANSION OF FACILITIES**
  Carter is geared to give service. We have increased our plant capacity to handle orders on an IMMEDIATE DELIVERY basis.
- **THE EXCLUSIVE CARTER DESIGN**
  Carter cylinders are designed for fast production and immediate off-shelf assembly from standard parts.
- **THREE SHIFT OPERATION**
  Carter produces around the clock. Your order for cylinders is in process *in a matter of minutes* after we receive it.
- **SPARE PARTS AND SERVICE**
  Carter maintains complete spare parts and experienced engineers in 40 different locations throughout the United States, Canada, and Mexico.
- **PHONE 24 HOURS A DAY**
  Call in your order any time of the day or night. Carter will take your order and begin processing it right away.

If you need cylinders fast, try us today.

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AIR CYLINDERS • AIR VALVES • HYDRAULIC CYLINDERS
ROTARY ACTUATORS • SPECIAL CONTROLS

LETTERS to the editor

area. We hope to cover this in a number of articles in subsequent issues. There is much work being done in this area at present, which is not ready for publication.

I was particularly interested in the series of articles on packings and seals you put together for the May issue; and now that I have read them, I want to congratulate you on a fine job.

OTTO J. MAHA
Vice President
Sales & Engineering
Hannifin Corporation
Des Plaines, Ill.

I would like two dozen reprints of the Leakage Control Articles appearing in your May issue. This is an excellent issue and I want to congratulate APPLIED HYDRAULICS on the thoroughness with which they approached this important subject. We are already applying some of your ideas.

L. B. HABERMAN
General Manager
Consolidated Diesel Electric Corp.
Stamford, Conn.

Complete reprints of all the articles appearing in the May issue are not available, but we do have some complete copies to send at 50¢ each.

Hydrostatic Transmissions

Under Letters to the Editor in our April issue, we ran a letter from C. W. Clifford, Liverpool, England, commenting on H. J. Hamblin's article "Fluid Motor In Drive Wheels", which appeared in the December 1956 issue. Mr. Clifford felt these difficulties would prevent using a hydrostatic transmission in farm tractors: A 60 gpm, 3000 psi pump would be too costly; excessive slippage would develop from working at 3000 psi for long periods; speed of 15 mph would require pump flow of 110 gpm. Here is Mr. Hamblin's answer.

A pneumatic-tired tractor, equipped with a transmission designed for a maximum pressure of

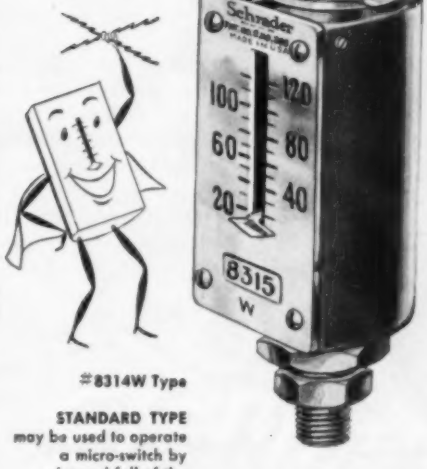
Continued on page 18

SCHRADER HYDRAULIC GAUGES DO THE JOB RIGHT...

keep accuracy under shock and overloads!

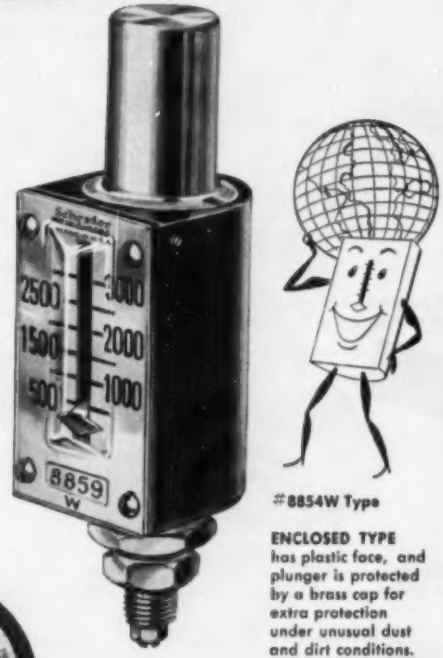
SHOCKPROOF HYDRAULIC PRESSURE GAUGES

are especially useful where space is limited. Engineered for long, hard use on all types of hydraulic machines. The Standard Gauges are industry's favorites.



#8314W Type

STANDARD TYPE may be used to operate a micro-switch by rise and fall of the plunger to start another sequence, etc.



#8854W Type

ENCLOSED TYPE has plastic face, and plunger is protected by a brass cap for extra protection under unusual dust and dirt conditions.

Shock 'em

Overload 'em

HYDRODIAL TYPE

SHOCKPROOF HYDRODIAL PRESSURE GAUGES

are completely enclosed units. Durable plastic face covers large, easy-to-read numerals that can be read from 50 feet. Easy to install and maintain.

Schrader Hydraulic Gauges give years of hard workhorse service. Famous shockproof Schrader hydraulic gauges are giving dependable service in thousands of plants of every description. The full line is built on the same rugged principle as other world-famous Schrader products. They operate on direct action, use the spring-loaded principle, and all replaceable parts are interchangeable. No special tools or skilled labor are needed for recalibration. All Schrader Hydraulic Gauges are available in nine standard pressure ratings up to 5000 psi. All have built-in snubbers.

Use the right gauge for the right job. Order Schrader by name from your supplier. Catalog data on request.

Schrader®
ESTABLISHED IN 1844

A. SCHRADER'S SON
A division of SCOVILL
456 Vanderbilt Avenue, Brooklyn 38, N. Y.

FIRST NAME IN THE USE OF AIR

FOR INDUSTRIAL PRODUCTION AND CONTROL

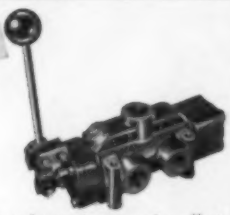
ADEL *Industrial Hydraulic Equipment*

for PEAK PERFORMANCE ADEL Hydraulic Valves and Pumps are setting new and ever higher standards for precision in manufacturing and efficient performance in operation. Following are but a few of the wide variety of models to meet all operating conditions.

GEAR-TYPE HYDRAULIC PUMPS

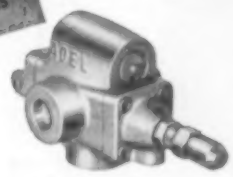
For 1000 psi service with rated capacities at 1800 rpm of from 1.5 to 46.8 gpm.

DIRECTIONAL CONTROL VALVES



4-way valves with spring-centered, spring-offset, and 1, 2, or 3 position detent action. 1500 psi. Flows to 28 gpm.

BY-PASS VALVES



Relief, Sequence and Unloading valves. Direct or remote operation, 50 to 1500 psi range.

VOLUME (FLOW) CONTROL VALVES

Compensated type maintains constant flow over wide differential pressure range. No drain line required. 1500 psi.

PILOT VALVES

2 or 3 position detent. With or without dog or lever. Can be used as 4-way valve in small circuits. 1000 psi.

CHECK VALVES

Valves allow free flow in one direction only. Many variations available. 3000 psi.

Reliability

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A DIVISION OF GENERAL METALS CORPORATION

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Haskel Engineering & Supply Co.
Seattle, Washington

LETTERS to the editor

3,000 psi, will probably never exceed 2000 psi in normal farm work, and for long periods may operate below 500 psi. Pressures of 3000 psi will only be reached as shock loads.

Transport speed of 15 mph is required, but the horsepower absorbed in transport is usually fairly low, and variable capacity motors not be necessary for speeds up to 15 mph.

Mr. Clifford is right regarding cost. There are pumps of the right size, weight and performance, but whether these will ever be available at sufficiently low prices remains to be seen.

I would like to invite Mr. Clifford to call on us for a personal discussion.

H. J. HAMBLIN
National Institute of Agricultural Engineering
Silsoe, Bedford, England

Credit Due Socony

We were happy to have you use illustration material from one of our Technical Bulletins in your article "How To Install A Packing, which appeared in your May issue. However, we hope in the future you will give adequate credit to Socony Mobile Oil Co. as the source.

R. B. PURDY
Lubricating Dept.
Socony Mobil Oil Co., Inc.
New York, N. Y.

We're sorry this credit line was omitted. Several of the figures were redrawn from your bulletins.

Small Pumps

We are anxious to secure information on small, high pressure hydraulic pumps for farm equipment, construction equipment and industrial applications.

G. J. GAUGHAN
Market Research Director
Standard Screw Co.
Bellwood, Ill.

Most pumps used for farm and construction equipment are gear

Continued on page 20

it gives—
and it takes
the higher the pressure—
the better the seal
NOTHING
GETS PAST
Hallprene
Hallprene
the seals that pressure can't lick
HALL &
HALL LTD
PATENT

P4309

Moisture Can Mean Trouble

In compressed air lines, moisture is a menace. Eliminating oil and moisture with Heat-X aftercoolers and moisture separators provides low cost insurance against receiver tank explosions, rusting and corroding of pipe lines, fouling of air instruments and freezing of water in pipelines and air tools. Units are easily installed on existing systems.

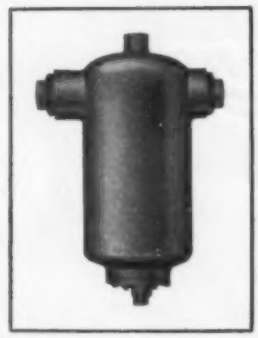
'WIA' AFTERCOOLERS

Cover the range from 100 to 1,000 C.F.M. Longitudinal Inner-Fin construction, *exclusive with Heat-X*, provides maximum heat transfer with minimum air side pressure drop . . . permits use of a more compact model. Units cool compressed air to within 10° F of temperature of available cooling water . . . use minimum amount of water.

heat-x

'RIA' REFRIGERATED AFTERCOOLERS

For use on systems where extremely dry air is required. Flooded refrigerant side operation, air flow through patented Inner-Fins, makes possible an extremely compact unit. Short length of tubings means low air side pressure drop and a rugged unit with no floating tube sheet. All copper and brass for corrosion resistance and long life. All welded construction.



MOISTURE SEPARATORS

These simple, rugged units separate water and oil that condenses in aftercooler . . . prevent passage of foreign particles into system. Available in capacities from 150 C.F.M. to 1,000 C.F.M.

Bulletins containing complete specifications FREE on request

HEAT-X, Inc.

BREWSTER • NEW YORK

LETTERS to the editor

and vane types, designed for 1000 psi. Recently gear and vane pumps have been developed for 2000 psi service. This equipment has a very good record of reliability. We have sent you a list of manufacturers who will be glad to give you specific information, and a copy of our December issue which featured mobile equipment applications.

Gaging Contamination

We are allowed .5 mg of contamination in 100 cc of oil. Much of this contamination is microscopic in nature. Is there a gage, or a piece of equipment, that will measure the amount of contamination in hydraulic oil?

STUART SPIRO
Quality Analysis Office
Air Arm Div.
Westinghouse Electric Corp.
Baltimore, Md.

We don't have information on a gage which will measure the fine degree of contamination which you require. Possibly some of our readers will be able to help out.

Water Hydraulics

I have seen a few systems using water soluble oils in press applications. Is this fluid combination used in many other types of applications?

L. D. LOCKE
President
Power Transmission Engineering Corp.
San Jose, Calif.

Most positive displacement, rotary pumps are designed to use hydraulic oils. Equipment using water with a 5 or 10% soluble oil for lubricity and rust prevention, primarily uses reciprocating type, plunger pumps. In general, water soluble oil systems are limited to very large installations where cost of oils might be prohibitive. Fire-resistance, of course, is an advantage of the water system. Due to poor lubricity of the water and oil fluid, components are generally more expensive than those designed for a full, oil hydraulic circuit. ▼▼▼

Circle 62 on Reader Service Card

Circle 14 →

BACKED BY A QUARTER OF A CENTURY OF LOCKHEED HIGH-PRECISION HYDRAULICS

Control valve

FOR FORK-LIFT TRUCK

This efficient dual control valve consists of two standard Lockheed units, one controlling the tilt cylinder and one the lift cylinder on a well-known make of fork-lift truck. It can, of course, be usefully employed in many other applications. The valve for the tilt cylinder, which is double-acting, is of the 4-way type. The lift cylinder is of the single-acting type and the 3-way control valve is used. The roller on the extension is designed to operate the pump motor switch.

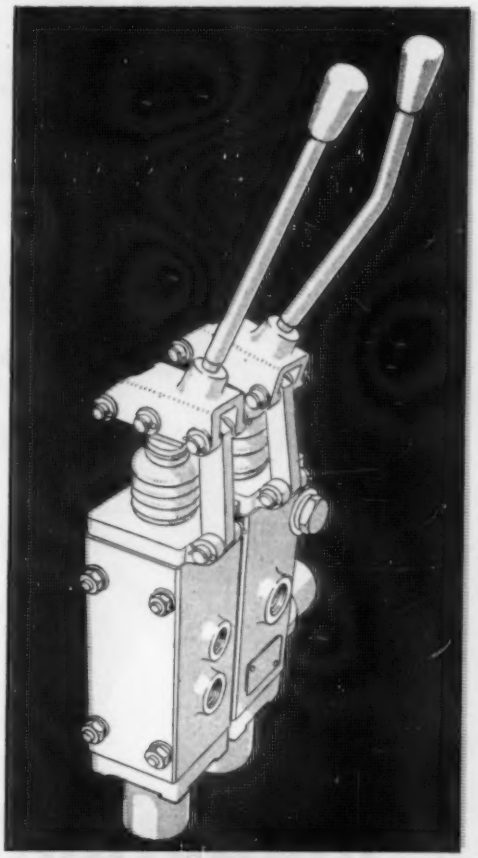
The unit can be supplied in a number of variations either with both 4-way valves or both 3-way valves, or with further valves to meet requirements.

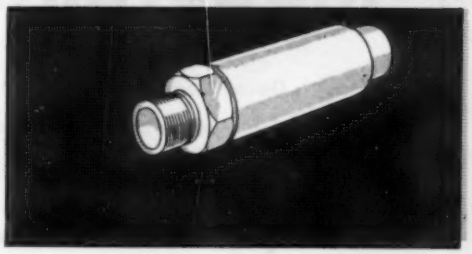
Used in conjunction with this valve is a flow control valve, illustrated on the side. This is a simple but important unit which maintains, at an approximately constant rate, the lowering of the fork of the truck, regardless of the load which it may be carrying.

This is but one of many highly specialized Lockheed hydraulic units, proved in a wide range of applications.

For further details please write for pamphlets, and kindly mention this journal.

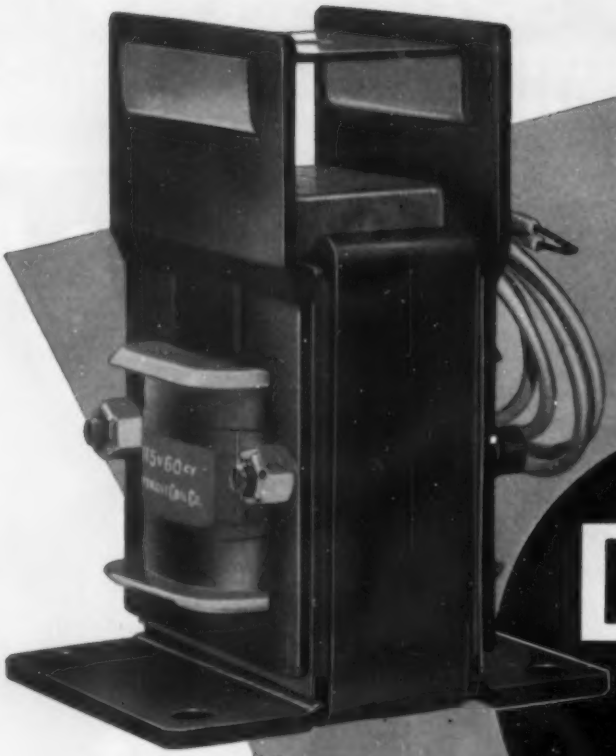
AUTOMOTIVE PRODUCTS COMPANY LTD.,
Shaw Road, Speke, Liverpool. Telephone: Hunts Cross 2121





Lockheed
REGD TRADE MARK
INDUSTRIAL HYDRAULICS

COMPLETE INSTALLATIONS BRITISH MADE OR INDIVIDUAL UNITS



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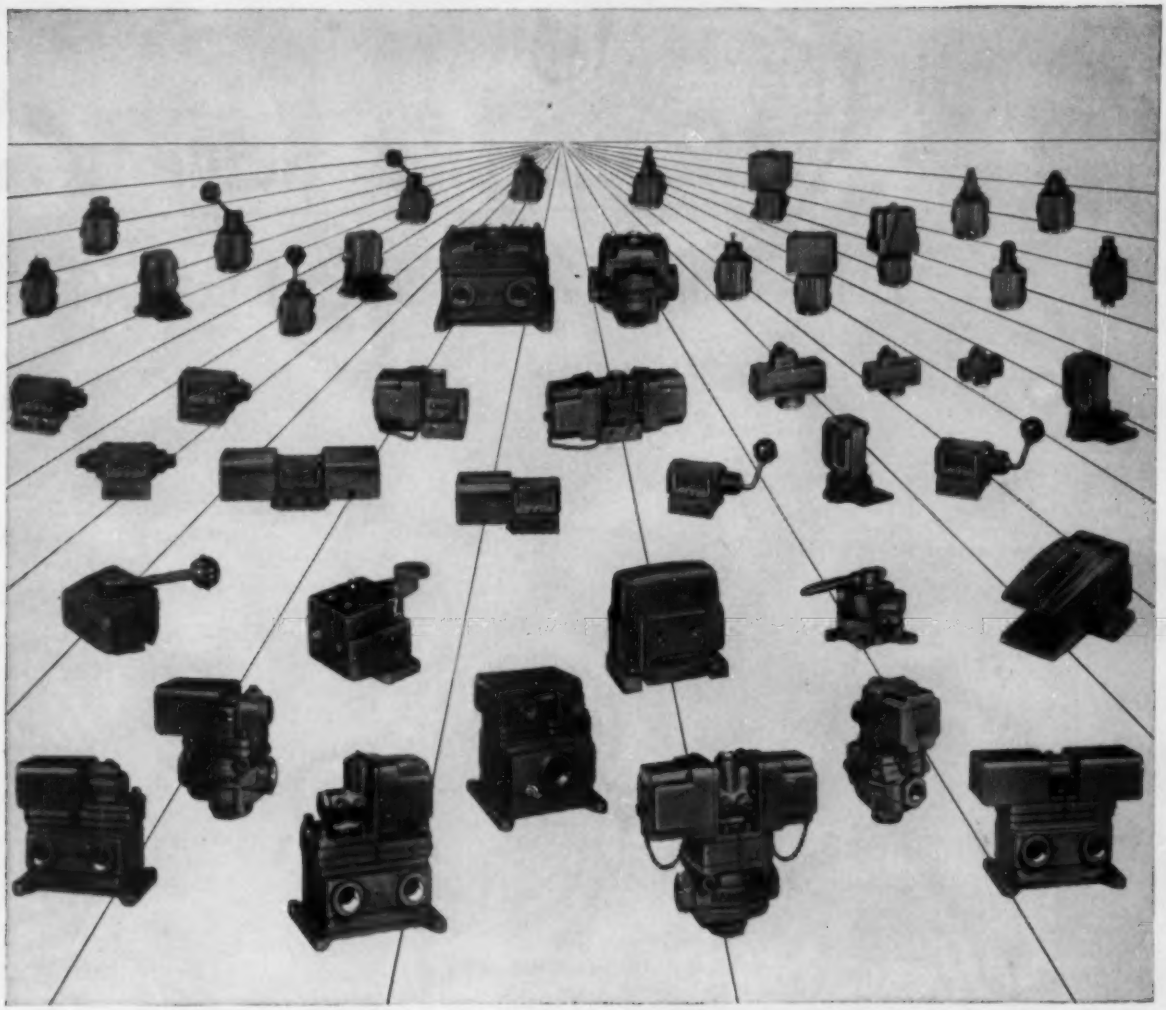

These valves like tough jobs

Discriminating engineers are finding that out. More and more of them are specifying Hannifin valves for every kind of directional air control—including the really tough jobs.

There are plenty of reasons why: Inspired simplicity of design. Fewer parts—and *those* easily and quickly replaceable. Ability to serve a wide range of applications with fewer valve models. And—above all—fast, smooth operation.

Your Hannifin man will gladly give you the whole story. We'll tell you where to get in touch with him—after you examine the big Hannifin catalog.

AIR CONTROL

HANNIFIN

VALVES

***For this complete catalog** showing all the Hannifin directional air control valves, write to Hannifin Corporation, 545 South Wolf Road, Des Plaines, Illinois.*

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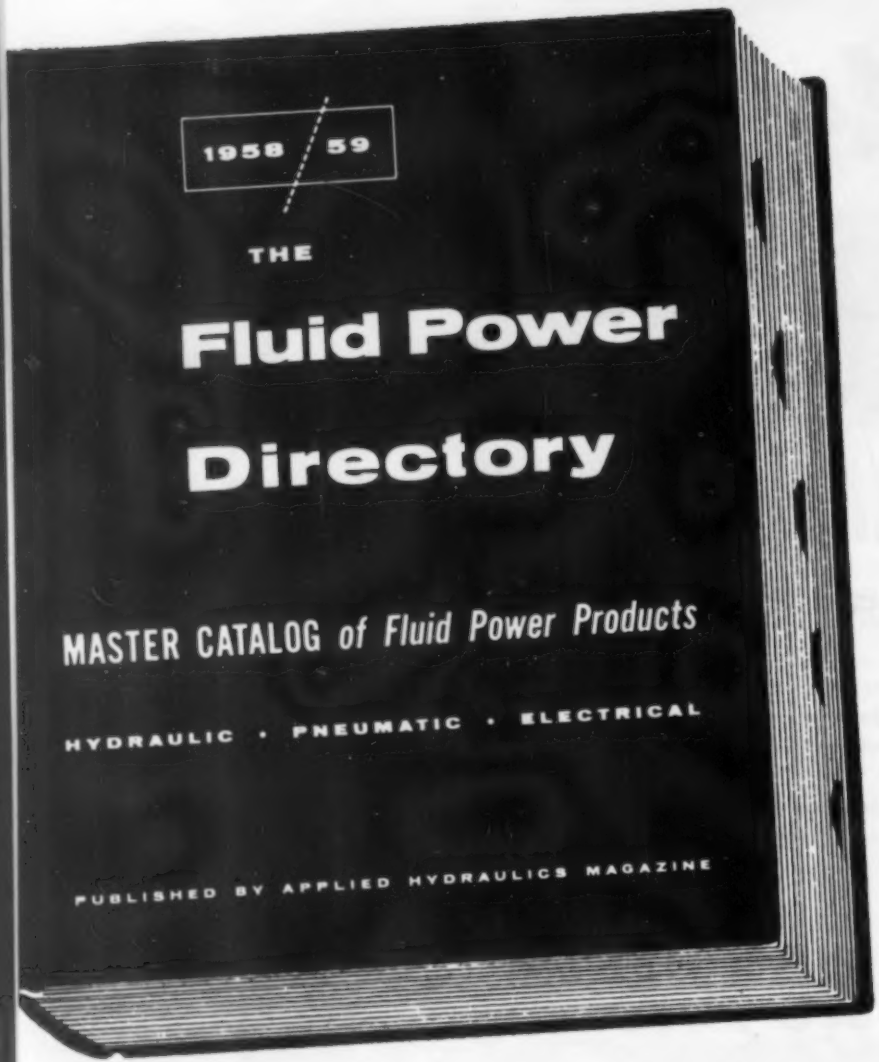
The Complete Guide to . . .

2nd EDITION . . . FLUID POWER DIRECTORY . . . . .



SECTION A

FLUID POWER COMPONENTS DIRECTORY—Over 140 pneumatic, hydraulic and electrical products for fluid power systems—from accumulators to wiper rings—are listed in this directory. Listings of advertisers appear in bold face along with the note "See Catalog Section C, pages ——— to ———".

SECTION B

TRADE NAMES—Alphabetical listing of product trade names gives manufacturers' names and addresses. Bold asterisk points out all advertisers in the Directory.

SECTION C

MANUFACTURERS' CATALOGS AND SALES OUTLETS—Manufacturers' advertising is arranged in alphabetical order. An index to these specification ads lists manufacturer's name and address of main plant; names and location of U.S. and Canadian representatives.

SECTION D

FLUID POWER DESIGN—224 pages of engineering reference material is divided into: JIC and ASA Standards, Nomographs, Design Data, Air and Oil Circuits, Product Information, and Applications and Developments.

SECTION E

WHERE TO BUY LOCALLY—The "Yellow Pages" supply information about local fluid component suppliers. Listing is alphabetical by state, city and company name. Advertisers in this section are independent sales companies.

. . FLUID POWER APPLICATION!

. . . . MASTER CATALOG OF FLUID POWER PRODUCTS

The only complete Hydraulic and Pneumatic Reference

YOUR HANDBOOK FOR FLUID POWER—This biennial volume—the 1958/59 edition—will be available in October. Since June 1955, the editors of APPLIED HYDRAULICS have been gathering and editing hydraulic and pneumatic information for this book. You will use the new edition of the FLUID POWER DIRECTORY as a time saver for all kinds of information about hydraulics and pneumatics.

The Components Directory Section lists more than 650 companies who manufacture products in the 140 indexed classifications from accumulators to wiper rings.

In this permanently bound volume, more than 150 manufacturers of fluid power components put their specification-type advertising in your hands—many will include condensed catalog information. Your 1958/59 Directory warrants being called the "bible" of fluid power application and engineering.

UP-TO-DATE INFORMATION—When you're looking for sources of components, or trying to locate the manufacturer of a part for which you have the trade name, or want to quickly locate the local source, or need spec data immediately, it's all in this book. And you have a big PLUS section which is only available in this volume—over 200 pages of Fluid Power Design information. It includes JIC and ASA Standards, nomographs, charts, formulae, a product encylopedia, over 150 circuits, plus applications and developments.

PUBLICATION DATE—OCTOBER 1957

16,000 1958/59 Directories will be put in the hands of men who select fluid power components. A recent survey made to users of the first edition published two years ago shows that each copy is used by more than 5 men. The book is designed for the hard use it gets. It helps every user save time in designing and building fluid powered equipment. Your copy will be your fluid power handbook.

NOTE TO ADVERTISERS—When your sales campaign has done its job, when your advertising campaign is getting you the recognition and the interest you've sought . . . don't break the connection! Make it easy for the buyers to find you when they want you.

File your condensed catalog information in the FLUID POWER DIRECTORY . . . it completes the sales connections!

You can reserve a copy now . . .

$6.50 PER COPY

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812 Huron Road, Cleveland 15, Ohio

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APPLIED HYDRAULICS

The Magazine of Fluid Power

812 HURON ROAD
CLEVELAND 15, OHIO

BRIEFS about fluid power

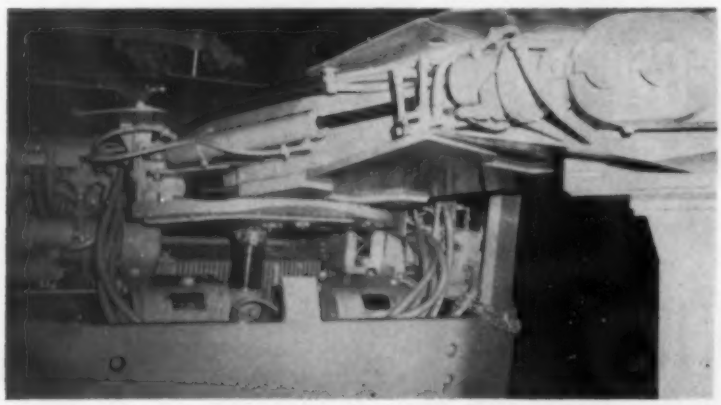
16 TONS—DUG FASTER AND EASIER . . . with fluid power

Not too long ago, a well muscled back, pick and shovel were the miners only tools. Today the pick and shovel are rusty, and fluid power is the muscle of the mining industry. Coal miners ride astride giant coal diggers that cut, shovel, scoop and load in one continuous operation. The miners push the levers and let fluid power do the work.

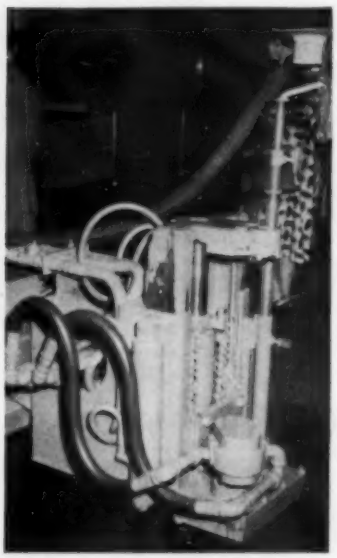
Well, perhaps it's not quite that easy, but if you'd gone to the 1957 Coal Show in Cleveland, you

Continued on page 28

The Compton Miner, Compton Inc., Clarksburg, W. Va. is 100% hydraulically controlled. The cutters are positioned by telescoping cylinders and driven by axial piston motors. The machine will deliver 5 to 7 tons per minute.



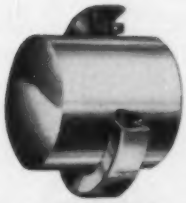
A 50 hp electric motor powers the hydraulic system of this type 400 continuous miner, Goodman Mfg. Co. A piston type 2200 psi fluid motor driven by a 20 gpm constant volume pump controls tramming. Another pump controls the conveyor raising and slewing cylinders, and a third 20 gpm pump powers the fluid motor driven conveyor belt shown in this photo.



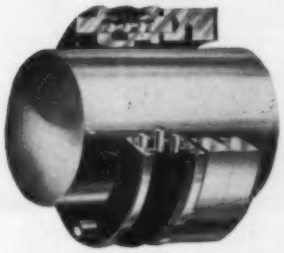
"Monkey on a stick" type motion doubler produces 7000 pounds of drill thrust on this Model D. J. roof drill of J. H. Fletcher Co., Huntington, W. Va. Designed for high capacity operations, it uses a 1500 psi, 220 ft. lb. torque gear pump. There are two separate hydraulic systems and two completely independent drilling heads with a drill feed rate of 18 ipm. and a return rate of 36 ipm., at 350 rpm.

C/R cooperative research

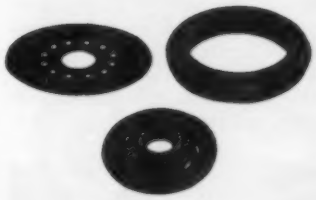
covers this wide range of products



SHAFT-TYPE OIL SEALS More than 20 types, forming over 7,500 size combinations for shafts from ¼" to 50" O.D., are available — thousands from stock. These seals are used for the vast majority of shaft sealing problems from simplest dust exclusion to high-speed, high-temperature fluid retention and foreign matter exclusion under extremely rugged operation where high sealing efficiency must be maintained over long service life.



END FACE SEALS For critical sealing problems outside the capabilities of shaft-type seals, there are C/R End Face Seals, which operate on the principle that two smooth, flat surfaces, one rotating on the other at right angles to the shaft, form a leakproof seal. They require minimum pressure to maintain face contact, create minimum friction, heat and power loss, and give unsurpassed performance under the most severe conditions.
Typical applications of C/R End Face Seals include: sealing track rollers of crawler tractors; sealing high-speed accessory drives in aircraft; sealing medium speed applications such as gear cases of washing machines, dishwashers and similar home appliances.



SIRVENE SYNTHETIC RUBBER PRODUCTS The advanced level of compounding and molding elastomers and special materials to critical tolerances achieved by C/R Sirvene Engineers is a widely established fact. They will design, compound and produce a part to your exact specifications of hardness, elasticity, and resistance to aging, temperature, oils, solvents or chemicals — with dimensional uniformity and consistent high quality, regardless of quantity. Holding to extremely close tolerances is standard procedure. A typical list of products includes oil seal packings, diaphragms, cups, boots, gaskets, plugs, impellers, valve inserts and way wipers — to name but a few. The experience and facilities available to you from C/R's Sirvene Division are unrivaled in the industry.

SIRVIS-CONPOR MECHANICAL LEATHER PRODUCTS The typical range of mechanical leather products includes oil seal packings, cups, boots, washers, gaskets, couplings and valve discs, but encompasses any part wherein high tensile strength, flexibility, high resistance to pressure, wear, shock, and vibration are desired. Cups of C/R's Conpor impregnated Sirvis leather products are operating at pressures up to 10,000 p.s.i. They are insoluble in most hydraulic oils and compatible with a wide range of other oils, solvents and gases. C/R boots of Sirvis leather, canvas, nylon or elastomer impregnated fabric can be produced in sizes two stories high or not bigger than your thumb for use in the protection of eccentric, universal or reciprocating action. Whatever your sealing or protection problem, bring it to Chicago Rawhide. C/R Engineers are constantly developing new mechanical leather designs for special and universal application.

Please write direct or contact your nearest C/R sales engineer about your problem in fluid sealing or related fields.

CHICAGO RAWHIDE MANUFACTURING CO.

Offices in 55 principal cities. See your telephone book.

In Canada: Chicago Rawhide Manufacturing Co., Ltd., Hamilton, Ontario
Export Sales: Geon International Corp., Great Neck, New York

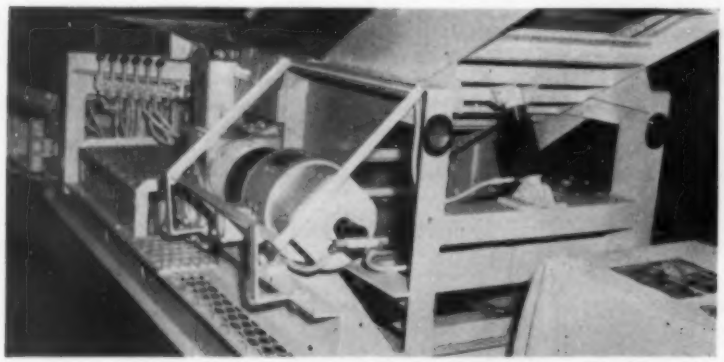
C/R Products: C/R Shaft and End Face Seals • Sirvene (synthetic rubber) molded parts • Sirvis-Conpor mechanical leather cups, packings, boots • C/R Non-metallic Gears • C/R Rawhide and nylon hammers.

C/R CHICAGO RAWHIDE

BRIEFS continued

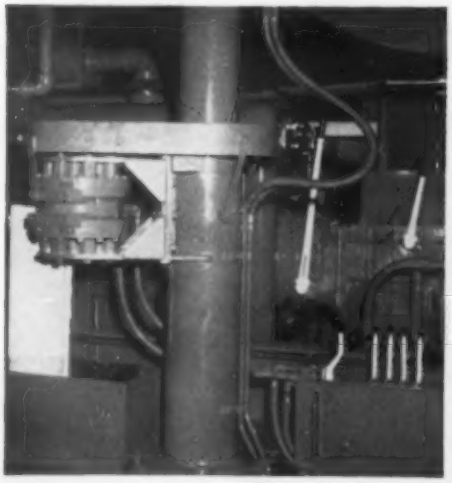
would have seen how modern methods have invaded the mines. Comparing this coal show with last year's, one fact is very apparent: mining equipment manufacturers are turning from man power to fluid power for almost all mining applications.

The American Mining Congress brought together over 200 manufacturers to display their latest products. Continuous miners, car loaders, rock drills, conveyors, track cleaners, mobile drills, rock dusters and multi-purpose vehicles were there in abundance. The photos on these pages review some of the fluid power features of the mining equipment. We had a good time; hope you caught the show. ▼▼▼

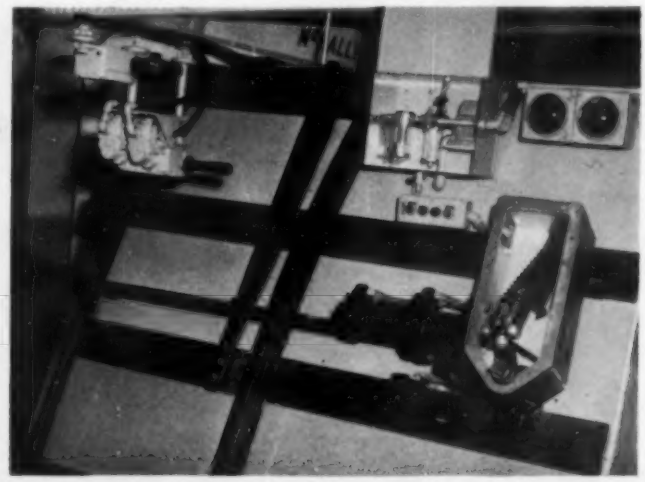


The small gear pump (bottom center) powers all the operations of this conveyor-loader except locomotion. The conveyor is built by American Mine Door Co., Canton, Ohio.

This truck mounted general purpose drill, built by Cardox Corp., Chicago can drill vertically, horizontally, or any angle in between. It is fluid motor powered and hydraulically controlled. The maximum feed rate is 20 fpm. with auger sizes from 3 to 12 in.



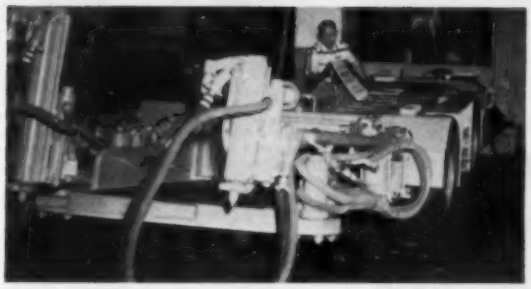
The drill boom of this McCarthy Coal Recovery Drill is rotated thru 200 degrees by the 1200 psi rotary torque actuator pictured here. The drill is built by Salem Tool Co., Salem, Ohio.



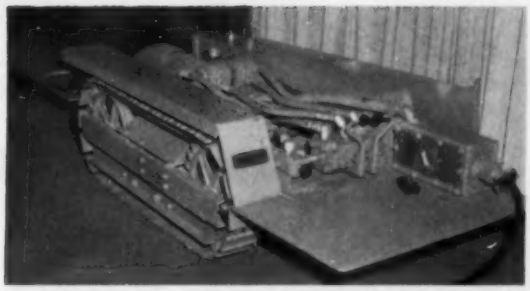
This track switch of the American Mine Door Co. is either 60-80 psi air or solenoid-air controlled. The display board pictured here demonstrates full air operation or pilot operated solenoid control. Full air operation is generally used when electricity is not available.

Five simple controls to operate this Cardox drill are grouped at the operator's station. The hydraulic cylinder is attached to the main frame and the piston rod to the auger support frame. Four hydraulic legs raise and lower the entire assembly to the desired height.

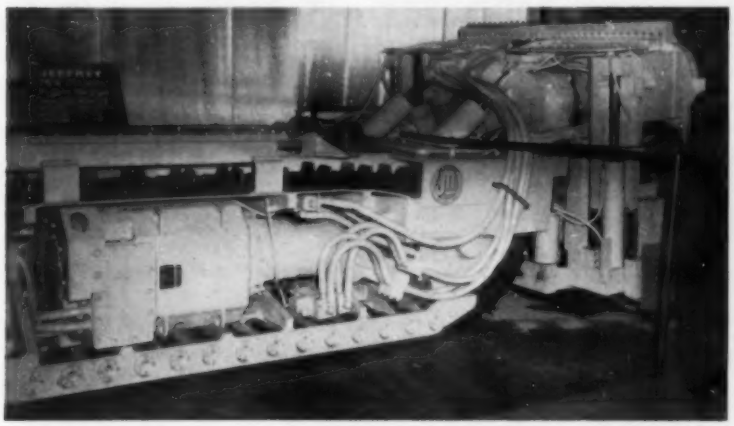
Joy Manufacturing Co. builds this continuous miner which makes full use of fluid power. Center of picture is a fluid motor powered drill. The machine digs 4.5 tons per minute with tramming speeds to 39 feet per minute.



A fluid motor on each individually suspended wheel is an outstanding feature of this Jumbolter made by Acme Machinery Co., Williamson, W. Va.



The Service Cat, manufactured by Schroeder Brothers Corp., Pittsburgh, Pa. can drill, doze, saw; be used as a winch or carrier. It is 23 in. high, has a 22 gal. oil reservoir and a $7\frac{1}{2}$ hp motor.



Each crawler on Jeffrey Mfg. Co's Colmol is driven independently by a hydraulic motor with mining speeds of 0-36 inches per minute and tramming speeds to 20 feet per minute forward or reverse. Separate hydraulic motors allow the Colmol to turn around within its own length. Fluid motors also drive the cutter heads through gear boxes on this model.

Lasting corrosion protection for valve stems in storage. Ordinary corrosion inhibitors fail to protect after the sacrificial metal is consumed. J-M No. 9 operates on an entirely different principle. Photograph shows how under accelerated tests, the sacrificial inhibitor (at left) failed after a few weeks *but the valve stem protected by J-M No. 9 (at right) was clean months later.* Specify J-M No. 9 inhibitor when you order J-M die-formed packing rings.

J-M Die-formed Packing Rings for all process fluids

Whether you are designing a bathroom fixture or a high-pressure valve, you can now choose your packing rings with greater certainty of both maximum sealability and easy assembly. For Johns-Manville has grouped its die-formed packing rings into three tolerance ranges—*dense, soft* and *metallic*—to fit your equipment needs.

Johns-Manville Die-Formed Packing Rings are precision-made for many fluid services including oils, tars, corrosives, solvents, fresh and salt water, steam to 1200 F, pressures to 3000 psi (on special valves to 60,000 psi). Special J-M rings with controlled friction are made for high-grade plumbing fixtures.

Check the tolerance chart below . . . your Johns-Manville Packing Representative will be glad to give you lists and descriptions of the styles in each range and those with which the J-M No. 9 Corrosion Inhibitor (*see right above*) may be specified or is standard. Write Johns-Manville, Box 14, New York 16, N. Y. In Canada, Port Credit, Ontario.

JOHNS-MANVILLE DIE-FORMED PACKING RING TOLERANCES	DENSE RINGS (including plastics)			SOFT RINGS (including cloth rings)			METALLIC RINGS		
	I.D.	O.D.	Depth	I.D.	O.D.	Depth	I.D.	O.D.	Depth
to and incl. ½" O.D.	+.008" −.000"	+.000" −.008"	±1/64"	+.008" −.000"	+.000" −.015"	±1/64"	+.008" −.000"	+.000" −1/32"	±1/32"
Over ½" to and incl. 1" O.D.	+.008" −.000"	+.000" −.008"	±1/32"	+.008" −.000"	+.000" −.015"	±1/32"	" "	" "	" "
Over 1" to and incl. 2⅜" O.D.	+.008" −.000"	+.000" −1/64"	±1/32"	+.010" −.000"	+.000" −1/32"	±1/32"	" "	" "	" "
Over 2⅜" O.D.	+.010" −.000"	+.000" −1/32"	±1/32"	+.010" −.000"	+.000" −3/64"	±1/32"	" "	" "	" "

Bevel (on all styles) ±5° when required

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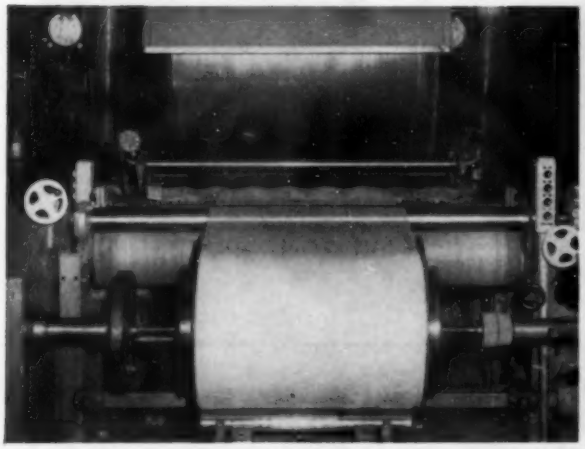
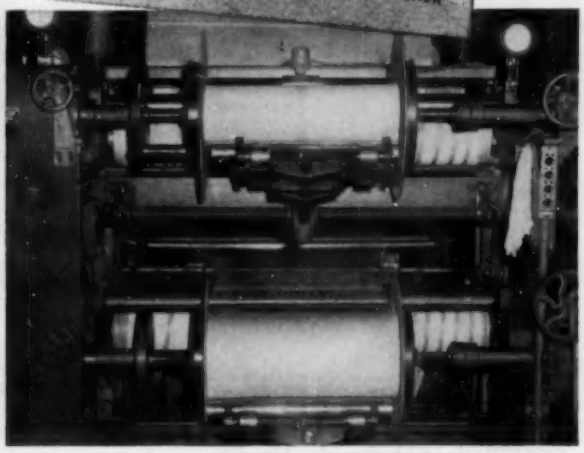
VICKERS® HYDRAULIC SLASHER DRIVES

WIND BETTER LOOM BEAMS FASTER

For

ANY TENSION • ANY SPEED • ANY SET
ANY YARN • ANY DIAMETER • ANY WIDTH
ANY HORSEPOWER • ANY DOUBLE HEAD
ANY SINGLE HEAD • ANY SLASHER





West Point Foundry & Machine Company single and double head slashers with Vickers Hydraulic Drives.

This is the slasher drive that can really meet *all* your needs . . . flexibility is sufficient to cover all known conditions of slashing. Now your yarn and your beams can be wound exactly the way you want them . . . and quality is always the same.

Design is unusually compact . . . the drive requires no floor space outside of the slasher head end frame dimensions. Automatic overload protection and dependability are important features. Completely sealed and inherently self-lubricated, there is no need for oiling and greasing.

ONLY VICKERS HYDRAULIC SLASHER DRIVES HAVE ALL THESE ADVANTAGES:

1. Better Tension Control
2. Complete Speed Range
3. Smoother Acceleration and Deceleration
4. Selective Creep Speeds
5. Better Response
6. Reduced Operating Costs

For further information about Vickers Hydraulics on slasher drives, write for Bulletin 55-71. For information regarding application of Vickers Hydraulics to general textile machinery, write for Bulletin 54-66.

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Machinery Hydraulics Division
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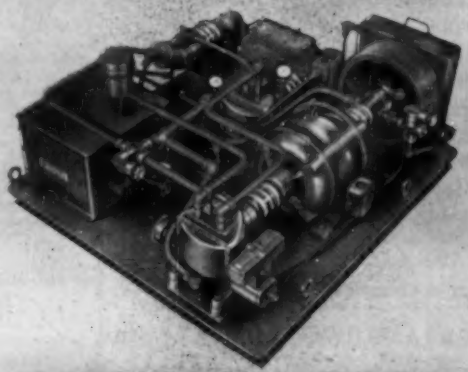
STANDARD VICKERS HYDRAULIC SLASHER DRIVE PACKAGE



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ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

ACCURATE TEMPERATURE CONTROL of Hydraulic Liquids PREVENTS LOSSES

• This NIAGARA AERO HEAT EXCHANGER cools the liquid for a large hydraulic press, preventing heat damage to the pump stuffing boxes. Using outdoor air as the evaporative cooling medium, it removes the heat at the rate of input (1,875,000 BTU/hr.) with no cooling water consumption except a negligible amount evaporated.

Similar Niagara machines cool water, oils, solutions, lubricants and coolants for many mechanical, electrical and chemical processes. In a closed system, your coolant is never contaminated. The system is simple and easy to keep up; the equipment has a long, useful life.

Write for Bulletin 120 for a complete description

NIAGARA BLOWER COMPANY
Dept. AH-7, 405 Lexington Ave.
NEW YORK 17, N. Y.
District Engineers in Principal Cities of United States and Canada

BRIEFS continued

More Power and Speed With New Hydraulic System

A breakaway capacity of 9000 pounds is one of the features of a new digger, manufactured by Sherman Products, Inc., Royal Oak, Mich. The hydraulic system utilizes pressures to 2000 psi, developed by a 13 gpm, 1500 rpm pump. The newly designed hydraulic stabilizers are individually controlled and have an eight foot spread with both lateral and angular support. A reinforced box construction boom permits heavy-duty operation. The crowd cylinder operates within this boom for protection when loading or digging. Twin, single-action, swing

cylinders are coupled to the swing sheave by a roller chain; the swing regulated by a combination flow control and cushioning valve. Maximum tooth pressure is achieved by using an actuating

Continued on page 34

BRIEF NOTES

NYLON BEARINGS OUTLAST BRONZE . . . lab and field tests by Vickers, Inc., Detroit, indicate service life of fixed and flexible bearings is increased by using nylon bearings, except in hydraulic oils at 275 F or higher.

SERVOSYSTEM ENGINEERING . . . for any industrial process or control requirement will be available from Servocontrol, Waltham, Mass., a new division of The Oilgear Co.

PLUG-IN PRESSURE GAGE . . . for hydraulic systems is available from Republic Manufacturing Co., Cleveland. Called Hydra-Chek, unit permits measuring fluid power pressures with a plug-and-jack type gage installation.

NEW PROCESS . . . for molding Teflon has been patented by Sparta Mfg. Co., Dover, Ohio. Articles as thin as 0.006 in. are now in quantity production. With the new process there is no loss of uniformity or tolerance. Thin sections having undercuts or return recesses can be molded to close tolerances.

BUSINESS BRIEFS

$2¼ MILLION EXPANSION . . . was announced by S. B. Taylor, president of The Parker Appliance Co., Cleveland. This includes acquisition of Franklin C. Wolfe Co., Culver City, Calif., and Mathewson Corp., Los Angeles.

SHARP UPCURVE IN SALES AND EARNINGS . . . is reported by Resistoflex Corporation, Roseland, N.J. This growth is largely due to special aircraft applications for the company's products. It is estimated that each jet engine built today uses $5000 of Teflon hose. Resistoflex 1956 sales were $5,687,000. A $10,000,000 year is estimated for 1957.

$81 MILLION WORTH OF NEW ORDERS . . . were booked in 1956 by Lear, Inc., Santa Monica, Calif., representing a 17% increase over the previous year.

"THEM THAT KIN BRAG" . . . without lying, let 'em brag"—so says Fluid Controls, Inc., Mentor, Ohio. Their 1956 business increased 65% over 1955. During the first three months of this year they shipped over 10,000 valves.

Miller

Sales and Service from Coast to Coast

. . . for quick, personalized service on your POWER CYLINDER NEEDS

Over 100 Miller Field Engineers . . . factory trained . . . fully experienced . . . specially qualified to render helpful, friendly cooperation from the strategic locations listed below.

Red areas indicate extent of Miller sales and service coverage. Black stars indicate district headquarter locations.

ALABAMA

Birmingham—Miller Fluid Power Power Div., 1925 29th Ave. S. Phone Tremont 9-6601

CALIFORNIA

San Francisco—Miller Fluid Power Div., 561 Buckingham Way. Phone Montrose 4-3531

Los Angeles—Teglen Engineering Co., P. O. Box 191, S. Pasadena. Phone Ryan 1-2856

COLORADO

Denver—Alta Engineering Co., 1988 Nome St. Phone Empire 6-3557

CONNECTICUT

Hartford—Gibson Engineering Co., 141 Washington St. Phone Chapel 7-6919

GEORGIA

Atlanta—Miller Fluid Power Div., 254 East Paces Ferry Rd., N.E. Phone Cedar 7-9933

KANSAS

Kansas City, Mo.—Miller Fluid Power Div., 410 West 40th Terrace. Phone Valentine 1-7475

ILLINOIS

Chicago (Home Office) — Miller Fluid Power Div., 2040 N. Hawthorne Ave., Melrose Park, Ill. Phone Fillmore 3-4500

Rockford—Miller Fluid Power Div., 4712 Cayuga. Phone Rockford 7-1308

INDIANA

Fort Wayne—Neff Engineering Co., 2339 Crescent Ave. Phone Eastbrook 7391

South Bend—Neff Engineering Co., 103 S. Varsity Drive. Phone Central 2-4856.

Indianapolis—Neff Engineering Co., 6101 College Ave. Phone Clifford 5-5418-19

IOWA

Miller Fluid Power Div., 916 25th St., Moline, Ill. Phone Moline 2-4282

KENTUCKY

Louisville—Charles Weber Co., 536 Eastern Parkway. Phone Melrose 7-2574

MARYLAND

Baltimore—Miller Fluid Power Div., 1515 Kirkwood Rd. Phone Ridgeway 7-9424

MASSACHUSETTS

Boston—Gibson Engineering Co., 1018 Commonwealth Ave. Phone Aspinwal 7-5074

MICHIGAN

Detroit—Miller Fluid Power Div., 7338 Woodward Ave., Rm. 404. Phone Trinity 2-1441

Grand Rapids—J. N. Fauver Co., 2147 Englewood Drive. Phone Cherry 5-1247

Flint—J. N. Fauver Co., G. 3140 E. Hemphill Rd. Phone Pilgrim 2-3300

MINNESOTA

Minneapolis—Miller Fluid Power Div., 2800 Foshay Tower. Phone Federal 5-0449

MISSOURI

St. Louis—Sturgis Equipment Co., 601 S. Taylor Ave. Phone Olive 2-5380

NEW YORK

New York City—C. H. Ribble Co., 31 Di Carolis Court, Hackensack, N. J. Phone Diamond 2-2602

Rochester—Miller Fluid Power Div., 114 Thistledown Dr. Phone Congress 6-1660 or Browning 1-2109

Buffalo—Miller Fluid Power Div., 28 Church St. Phone Madison 3993

OHIO

Akron-Youngstown—Miller Fluid Power Div., P. O. Box 150, Sebring, Ohio. Phone Sebring 8-6368

Cleveland—Miller Fluid Power Div., 12703 Triskett Rd. Phone Clearwater 2-3131

Dayton—K. C. Mosier Co., 628 Ludlow. Phone Michigan 9805

Columbus—K. C. Mosier Co., 549 N. Columbia. Phone Capital 1-7120

Lima—K. C. Mosier Co., 1566 N. Union. Phone 6-8616

Cincinnati—K. C. Mosier Co., 6119 Cary. Phone Garfield 1-1023

Toledo—J. N. Fauver Co., R.F.D. Dutch Road, Waterville, Ohio. Phone Waterville 3598

PENNSYLVANIA

Philadelphia—Miller Fluid Power Div., 1468 York Rd., Abington, Pa. Phone Turner 4-4905

Pittsburgh—Ralph Hiller Co., 4133 Brownville Rd. Phone Tuxedo 2-7353

TEXAS

Houston—Hydraquip Corp., 6645 Navigation Blvd. Phone Walnut 6-8301

WASHINGTON

Seattle—George W. Warden Co., 1305 Dexter Ave. Phone Alder 0622 or Adams 0150

WISCONSIN

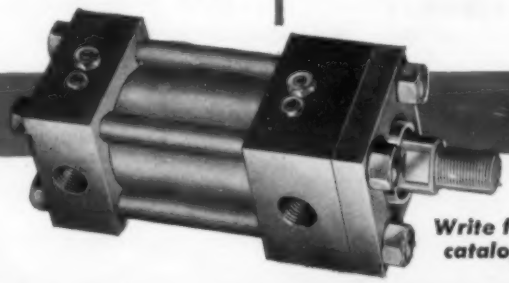
Milwaukee—Fluid Power Equipment Co., 3320 Green Bay Ave. Phone Concord 4-0046

QUEBEC, CANADA

Montreal—Miller Fluid Power Div., 520 Curzon St., St. Lambert, Montreal. Phone University 1-1304

ONTARIO, CANADA

Toronto—Miller Fluid Power Div., 4158 B. Dundas St. Phone Belmont 3-0831



Write for catalog

Miller — FLUID POWER DIVISION
Flick-Reedy Corp.

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AIR & HYDRAULIC CYLINDERS • BOOSTERS • ACCUMULATORS
COUNTERBALANCE CYLINDERS

Want to control air or hydraulic circuits electrically'

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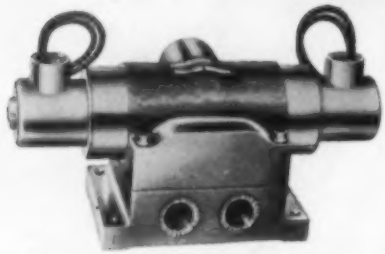
SOLENOID VALVES

for air or hydraulic service to 150 psi



MV SERIES double solenoid for 3 or 4-way operation in ¾" and 1" port sizes is only 13¾" long. Shown with removable sub-base; also available in threaded body, and with single solenoid.

MV SERIES single solenoid in ⅜" and ½" port sizes is only 7⅜" long. Available in same styles as larger MV, at top.

Ultra-compact BV series with ¼" ports is only 4½" long; made in single or double solenoid for 3 or 4-way operation.

1. "O" RING SEALING for extra-long service life, easy replacement without removing valves from line.

2. NON-CORROSIVE CONSTRUCTION throughout — cast aluminum body, brass porting sleeve, aluminum sliding spool.

3. COMPACTNESS... note dimensions, figure the space you'll save!

4. EASY INSTALLATION... MV Series are available in threaded body or removable sub-plate or manifold mountings; BV series has rectangular body with flat surfaces for easy mounting.

5. WIDE SELECTION... Modernair offers a full range of port sizes, (¼", ⅜", ½", ¾", 1") in single or double solenoid types, for 3 or 4-way operation; solenoids available for either a.c. or d.c. in all popular voltages.

WRITE TODAY for new 20-page condensed catalog (filed in Sweet's 1957 Product Design File, Section 6a/Mo), and applications data; please address Dept. B-7.

Modernair

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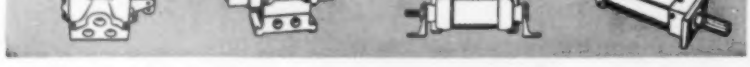
MEMBER OF NATIONAL FLUID POWER ASSOCIATION



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BRIEFS continued

cylinder and a geometry of linkage. The 15 gallon hydraulic reservoir, oversized for maximum oil cooling, is centrally located and suspended within the main frame to reduce leakage. A full-flow, reusable filter purifies the oil before it reaches the pump. ▼▼▼

Fluid Power Positions Parts

Hydraulically and electrically automated 8-station horizontal rotary index arc-welding machine, designed by Expert Welding Machine Co., Detroit, Mich., accurately positions and welds two

piece production parts. In one operation, an overhead air cylinder moves downward clamping one piece in place. A tee clamp, operated by an air powered rack and pinion gear clamp the other piece in the correct position. Tack welds are then automatically made.

In a later operation, the tack welded assembly is clamped in place by means of an air-powered quill. The quill, which is connected to a hydraulic motor, rotates the tack welded assembly through 360 degrees while welds are made on each side of the part. ▼▼▼

NCIH Proceedings Now Available

Proceedings of the 12th Annual Meeting of the National Conference on Industrial Hydraulics have been published in a 274-page cloth-bound book. All papers presented

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Garlock "makes the grade" with Galion... for over 30 years

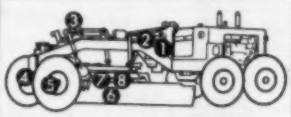
Now celebrating their 50th Anniversary, the Galion Iron Works and Mfg. Co., of Galion, Ohio is a leader in its field, and Galion Road Rollers and Motor Graders enjoy a reputation for long life and easy operation. For 30 years Garlock CHEVRON* Packings have been selected for the hydraulic cylinders of both Galion Road Rollers and Motor Graders. In fact, all eight models of the Motor Grader use CHEVRON Packings exclusively on hydraulic cylinders operating the blade, leaning front wheel, booster steering and various attachments.

The distinctive and exclusive CHEVRON design is extremely sensitive to pressure changes and ideally suited to use in shallow stuffing boxes. As pressures increase the CHEVRON Packing Rings automatically tighten to prevent leakage. As pressures decline the CHEVRON Rings instantly ease off permitting free operation without leakage. That's why cylinders using CHEVRON Packings require minimum attention and maintenance.

Exclusive CHEVRON is one more part of "the famous Garlock 2,000"... two thousand different styles of packings, gaskets, and seals for every need—the only complete line. It's one reason why your Garlock representative can provide you with unbiased recommendation. Call him today or write for CHEVRON Folder AD-115.

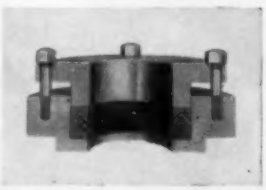
THE GARLOCK PACKING COMPANY, Palmyra, N.Y.

For Prompt Service, contact one of our 30 sales offices and warehouses throughout the U.S. and Canada.



Garlock CHEVRON Packing Rings used in 8 hydraulic cylinders on Galion Motor Graders:

1. Left Blade Lift Cylinder
2. Right Blade Lift Cylinder
3. Scarifier Cylinder
4. Leaning Wheel Cylinder
5. Booster Steering Cylinder
6. Moldboard Shift Cylinder
7. Tilt Moldboard Cylinder Right
8. Tilt Moldboard Cylinder Left



This design is entirely different from ordinary V-type packing. CHEVRON has an exclusive construction which assures the automatic action for which it is designed. Also permits the use of less packing in shallower stuffing boxes.

GARLOCK

Packings, Gaskets, Oil Seals, Mechanical Seals, Rubber Expansion Joints, Fluorocarbon Products

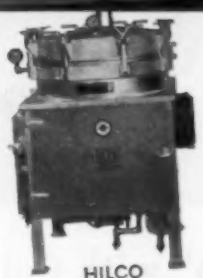
*Registered Trademark.

Keep YOUR HYDRAULIC SYSTEM Clean with HILCO HYDRAULIC OIL FILTER

- No More Varnish and Sludge Deposits
- No More Flushing and Manual Cleaning
- No More Frequent Oil Changes
- No More Accumulation of Dirt

Filter life up to a year eliminates usual frequent draining, refilling of systems.

HILCO Hyflow Oil Filters trap dirt, acids, rust, sludge, gums, resins . . . all solid contaminants, and keeps your hydraulic system clean and in top running condition at all times. To you, this means longer oil life, reduced wear and abrasion . . . hence, less down time and lower maintenance costs giving you continuous equipment operation with increased production. Hydraulic unit sensitivity depends upon a clean system. HILCO Hyflow filters remove solids as soon as they enter the system and retain much of the moisture which enters the oil from the atmosphere and from condensation. Obtain the full capacity and economy of your equipment by keeping it in top running condition with HILCO. Hydraulic Oil Filters come in stationary or portable models. They can be hooked into hydraulic systems without interrupting equipment operation.



HILCO
OIL RECLAIMER

For complete oil reclaiming. Removes solids, acids and volatile impurities; moisture, solvents, gasses, etc., from hydraulic fluids by heat-vacuum process.

• SEE FOR YOURSELF HOW HILCO keeps your Hydraulic System Clean . .

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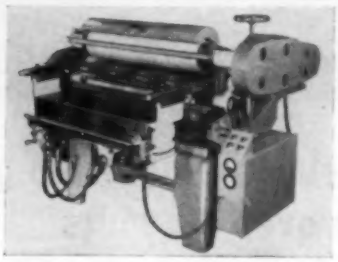
IN CANADA:

BRIEFS continued

at the meeting are given in complete form, including illustrations. Material covered includes Nuclear Reactors, Pumps, Components and Accessories, Pneumatics, Servomechanisms and Systems, Mobile Equipment, Aircraft Systems, Hydraulic Fluids, Presses and Automotive developments. The Proceedings should provide valuable information to fluid power engineers as they cover many of the latest developments, such as higher speeds and pressures for pumps, Teflon packings, finer filtration requirements, design and operation of servomechanisms and fire-resistant fluids.

Copies of the Proceedings may be obtained from the Conference Secretary, National Conference on Industrial Hydraulics, Illinois Institute of Technology, Technology Center, Chicago 16, Ill., at $5 per copy. ▼▼▼



This glazer and mirror finisher for the cutlery industry features accurate correlation of roll contact pressure by an adjustable automatic pressure regulator. The rolls can withstand forced opening without damage because they float against controlled air pressure. This sensitive air floating action of the rolls assures uniform contact pressure regardless of taper. Predetermined maximum contact pressure can be applied without fear of localized burning or damage to blade tips. The machine is powered by two 10 h. p. spindle motors and one 2 h. p. hydraulic pump motor. It was built by Clair Mfg. Co., Olean, N. Y.

Forging Hammer Has Infinitely Variable Stroke

An air-operated forge hammer which allows the operator to select any length stroke by varying the

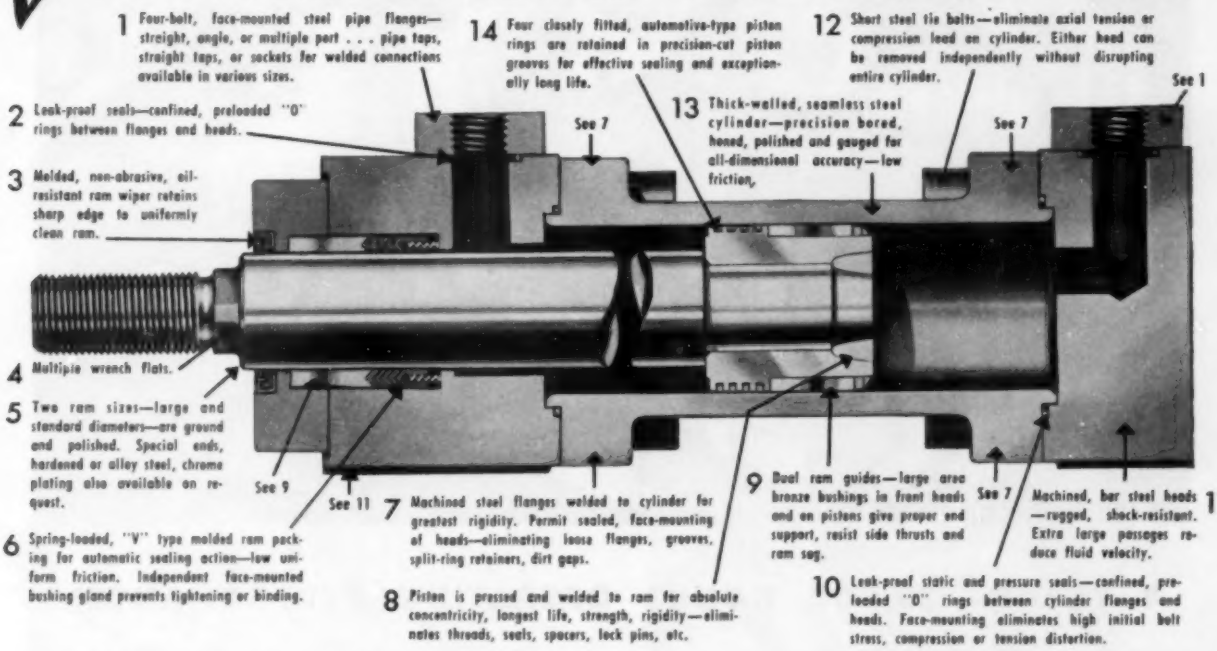
Continued on page 40

. . . Fluid Power news

NEW HEAVY DUTY CYLINDERS

NOW AVAILABLE—New Oilgear "Custom-Quality" Line of Heavy-Duty, 3,500 psi Cylinders

✓Check . . . Compare these 20 "Custom-Quality" features:



1 Four-bolt, face-mounted steel pipe flanges—straight, angle, or multiple port . . . pipe taps, straight taps, or sockets for welded connections available in various sizes.

2 Leak-proof seals—confined, preloaded "O" rings between flanges and heads.

3 Molded, non-abrasive, oil-resistant ram wiper retains sharp edge to uniformly clean ram.

4 Multiple wrench flats.

5 Two ram sizes—large and standard diameters—are ground and polished. Special ends, hardened or alloy steel, chrome plating also available on request.

6 Spring-loaded, "V" type molded ram packing for automatic sealing action—low uniform friction. Independent face-mounted bushing gland prevents tightening or binding.

7 Machined steel flanges welded to cylinder for greatest rigidity. Permit sealed, face-mounting of heads—eliminating loose flanges, grooves, split-ring retainers, dirt gaps.

8 Piston is pressed and welded to ram for absolute concentricity, longest life, strength, rigidity—eliminates threads, seals, spacers, lock pins, etc.

9 Dual ram guides—large area bronze bushings in front heads and on pistons give proper end support, resist side thrusts and ram sag.

10 Leak-proof static and pressure seals—confined, preloaded "O" rings between cylinder flanges and heads. Face-mounting eliminates high initial bolt stress, compression or tension distortion.

11 Machined, bar steel heads—rugged, shock-resistant. Extra large passages reduce fluid velocity.

12 Short steel tie bolts—eliminate axial tension or compression load on cylinder. Either head can be removed independently without disrupting entire cylinder.

13 Thick-walled, seamless steel cylinder—precision bored, honed, polished and gauged for all-dimensional accuracy—low friction.

14 Four closely fitted, automotive-type piston rings are retained in precision-cut piston grooves for effective sealing and exceptionally long life.

15 Adjustable hydraulic cushions—dash pots—for front, rear, or both heads. New, exclusive Oilgear floating-sleeve design assures superior performance, longer life, less wear—eliminates check valves.

16 Eight basic sizes—2", 2½", 3¼", 4", 5", 6", 7", 8" . . . length of stroke varies from 36" to 158". Longer stroke available on request.

17 Air vent plugs, double end rams, special ram ends, special packings for use with fire-resistant fluids are also available.

18 Choice of fixed mountings—foot lug, center lug, or flange—can be combined or interchanged, front or rear, to suit any requirement.

19 Choice of hollow trunnion mountings—rear, center, front—accurately machined, integral with heads. No hoses or slide joints—Oilgear's exclusive steel flange connectors—rugged, leak-proof, rotate smoothly.

20 Designed and built to the highest standard of quality for the most dependable, trouble-free, long life. Machinery builders and users alike, say—"For the lowest cost per year—it's Oilgear!"

STANDARD MOUNTINGS

Front and rear foot lug mounting

Front and rear center lug mounting

Heads can be combined or interchanged

Rear flange mounting plain front head

Front flange mounting plain rear head

Rear trunnion mounting plain front head

Front trunnion mounting plain rear head (not shown)

Center trunnion mounting, plain front and rear heads

Complete user satisfaction is guaranteed by Oilgear's extensive research, testing, over 35 years of design, manufacturing, and application experience in the field of Fluid Power—both oil and fire-resistant fluids.

For further information on these new cylinders, call your Oilgear Application-Engineer. Or write for bulletins 73000 and 73245 directly to . . .

THE OILGEAR COMPANY

Application-Engineered Fluid Power Systems

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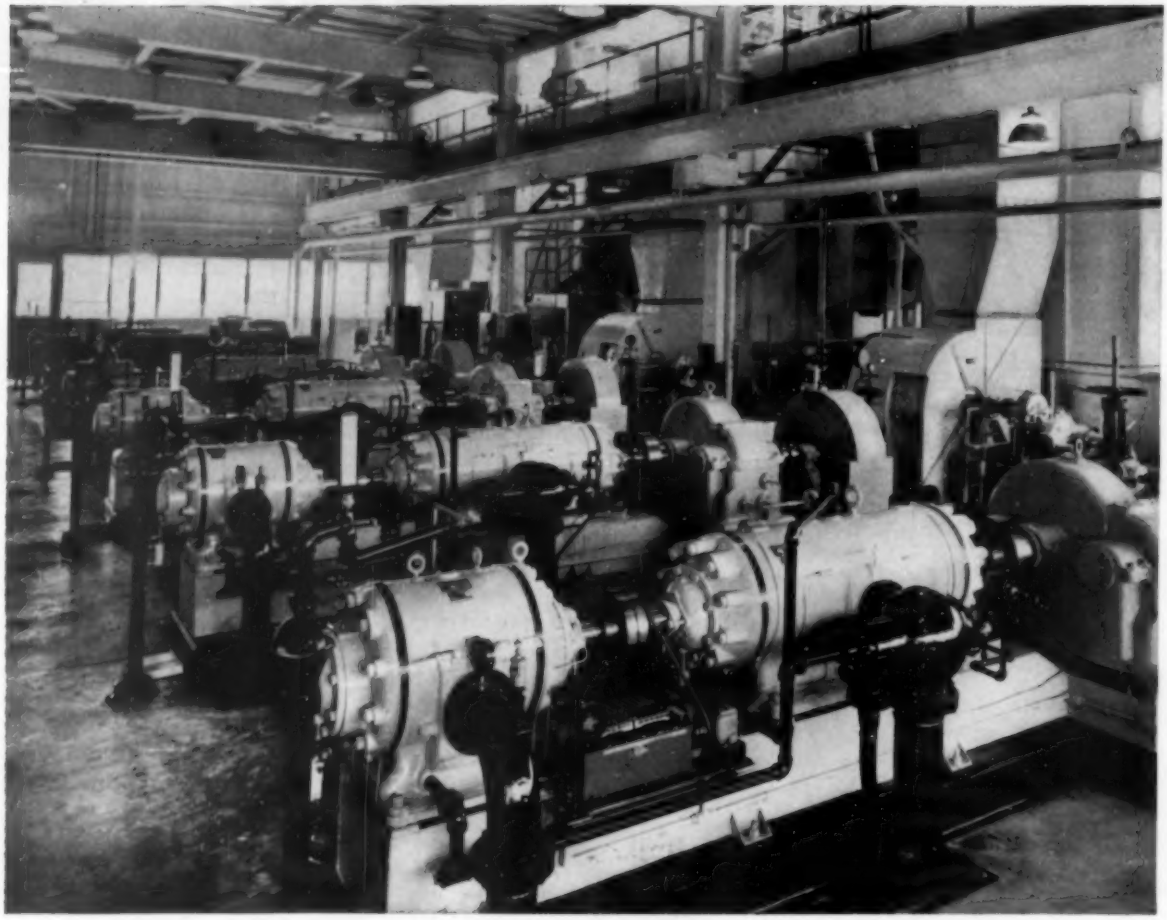

4 YEARS - - 25,000 HOURS OPERATING PERFORMANCE!

This is just one of many production records set by Fuller Rotary Compressors—in this case by each of six machines installed in a leading aircraft plant. The only maintenance or replacement necessary over this period was installation of high and low pressure blades. Bearings held up 100%.

Fuller rotary compressors shown are four C-300-300H, steam turbine drive, capacity each 1248 to 1805 c.f.m., with speed ranges of 450 to 650 r.p.m., 125-lb. gauge pressure, and two electric motor drive, capacity each 1663 c.f.m., at 600 r.p.m., 110 lb. gauge pressure.

Your plant, too, can take advantage of the many cost-saving advantages of Fuller rotary compressors; such as smooth airflow, lack of vibration minimum of moving parts, adaptability to any production setup, and the advantage of "one man" operation.

Write today to Fuller Company and get complete data on how Fuller rotary compressors can give you more air power at less cost.

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PIONEERS OF HIGH-EFFICIENCY VANE TYPE ROTARY COMPRESSORS SINCE 1930

Aeroquip Hose Lines with Reusable Fittings —the Answer to Hydraulic Design Problems

HUNTINGDON INDUSTRIES USES AEROQUIP ON AUTOMATIC ASSEMBLY MACHINERY

Aeroquip Hose Lines simplify fabrication of complex hydraulic systems on automatic partition assembling machinery made by Huntingdon Industries, Meadowbrook, Pa. With Aeroquip Bulk Hose and Reusable Fittings, Huntingdon personnel assemble hose lines of any length quickly, easily, using ordinary bench tools.

Simplify your hydraulic design problems with these Aeroquip Hose Lines: 1509 Hose for petroleum and water base systems up to 5000 psi.; 1503 and 1502 Hose for petroleum and water base systems up to 3000 psi.; 1546 Hose for fire resistant phosphate ester base systems up to 5000 psi.; 1532 Hose for fire resistant phosphate ester base systems up to 3000 psi. Write for full information; see our catalog pages in Sweet's Product Design File, Section 6d.

Aeroquip Flexible Hose Lines are easy to install, even in confined spaces as the hydraulic positioning table on this automatic partition assembler.

Using Aeroquip Bulk Hose and Reusable Fittings, hose lines of standard or varying lengths can be made up quickly by Huntingdon personnel.

On this hydraulic motor, Aeroquip Hose Lines give long dependable service. When replacement lines are needed, they can be made quickly.

Aeroquip

REG. TRADEMARK

AEROQUIP CORPORATION, JACKSON, MICHIGAN

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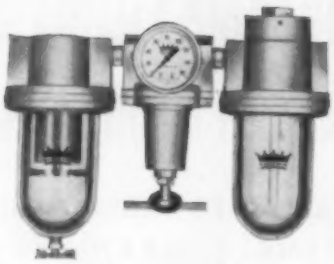

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Hannifin's newest development, the Crown Line of FILTERS, REGULATORS and LUBRICATORS, saves money wherever air power is used. The filters remove dirt and scale without robbing you of precious power. The regulators let more air through when it's needed than other regulators do. The lubricators operate on minimum pressure differential —they are quicker and easier to fill, too. Available now—local, distributor stocks in many areas. Write for bulletins and for name of nearest distributor.

"COMBO" UNITS Bulletin 300

REGULATORS Bulletin 301

FILTERS Bulletin 302

LUBRICATORS Bulletin 303

COMPLETE RANGE OF SIZES

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FILTERS • REGULATORS • LUBRICATORS

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Send me your Crown Bulletins and name of nearest distributor.

Name.....

Position.....

Firm.....

Address.....

City.....*State*.....

BRIEFS continued

pressure on the hammer's treadle is built by Erie Foundry Company, Erie, Pa. The hammer operating valve is housed in the crown. The lower part of the main cylinder, and the cylinder to operate the clamps are also in the crown. The cylinder is equipped with a safety head which provides a cushion of steam or air to absorb the energy developed by the ram and rod if the hammer is overstroked. Inching of the ram is achieved through a separate control which permits air or steam to bleed into the cylinder. When the treadle is used in conjunction with the inching control, the ram can be slowly lowered and stopped at any desired point. ▼▼▼

Briefs from Britain

Compressor Is Powered By Gas Turbine

An experimental gas-turbine powered air compressor has been built by Alfred Bullows & Sons Ltd., Walsall, England. Powered by a Rover IS/60 gas turbine which develops 60 hp at 46,000 rpm, the compressor delivers 300 cfm at 100 psi.

• **Portable**—Weighing only 500 lbs., there should be no difficulty in mounting the turbine-compressor as a portable unit. Such a unit would offer light weight, compactness and freedom from maintenance. ▼▼▼

Hydrostatic Transmissions

. . . were among many interesting exhibits displayed by the British Hydromechanics Research Association during its show in May.

• **Ball-piston unit**—One of the infinitely variable speed transmissions was a radial, ball-piston pump with an eccentric track ring, ported to a radial, ball-piston motor. Unit features quick response to the operator's control pedal. Maximum output is 2 hp with speeds from zero to 6000 rpm. Output shaft can be accelerated from zero to 3000 rpm in less than one revolution.

• **Axial-piston unit**—This drive was developed to investigate possibilities for use with road vehicles and passenger cars. An axial-piston pump is ported to a swash-plate motor, also of the axial-piston type.

• **Seals**—Research is being carried on by BHRA in measurement of leakage from reciprocating and rotary seal, plunger pump valves, rotary shaft seals and effect of hydraulic pressures on locking of piston type valves and effect of tapers and clearances in eliminating this. While a valve may lock at low pressures, distortion at higher pressures may free the piston. ▼▼▼

Hydraulics In British Mines

Much hydraulic equipment is now going underground to speed the flow of coal from British pits. An important contribution from the British hydraulic industry is the Pit Prop, manufactured by Dowty Mining Equipment Ltd., Ashchurch, England.

• **Prop testing**—For the service testing of these props, Dowty produces a large test rig for surface use at collieries and area workshops, and a smaller unit for testing at the coal face. The main feature of each unit is a hydraulic ram, fed by a hand-pump from a reservoir, and incorporating a pressure gage. The ram com-

Continued on page 42

CHOICE OF BUILT-IN VALVES GIVES CONTROL FLEXIBILITY

SINGLE AIR CONNECTION SIMPLIFIES INSTALLATION

RUGGED CONSTRUCTION ASSURES LONG LIFE

125 BELLOWS SALES AND SERVICE FIELD ENGINEERS

■ There are one or more Bellows Field Engineers in every industrial area of the United States and Canada. They will be happy to work with you in applying "Controlled-Air-Power" to your machine designs. They are listed in their local phone directories under "The Bellows Co."

758-B

Four reasons why THE BELLOWS AIR MOTOR stands first with design engineers

In designing for air cylinder operation the engineer wants first of all sure, positive control, easily interlocked to related machine movements. **He has it in The Bellows Air Motor.**

He wants simple installation, uncomplicated by cumbersome piping. **He has it in The Bellows Air Motor.**

He wants rugged construction — an air cylinder that will stand up day in and day out with minimum requirements for service and repairs. **He has it in The Bellows Air Motor.**

But he also wants the knowledge, if service should ever be needed, that it is quickly available wherever his machine may go. **He has it in The Bellows Air Motor.**

The Bellows Co.

AKRON 9, OHIO

This free booklet offers interesting data for the design engineer. Write for it today. Address Dept, AH-757. Ask for Bulletin BM-25. The Bellows Co., Akron 9, Ohio. In Canada: Bellows Pneumatic Devices of Canada, Ltd.

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THE RIGHT PACKINGS
FAST
Engineering Service • Large Capacity
Page will give you helpful, intelligent engineering service . . . take your packings problem from its present stage and help you arrive at the best packings for your purpose. Their recommendations are based on three-quarters of a century of experience and know-how, backed by laboratory and testing facilities . . . and a plant that can turn out your packings by the thousands.
You Can Depend on Page
Page's reputation for helpful cooperation, sound engineering recommendations as to design and materials, and precise production in any quantity on schedules that fulfill promises has been built up in 88 years of working with hundreds of items in the field of industrial leathers. You can depend on Page to help solve your packings problems and to supply your needs in leather and synthetic U's, V's, Cups, Flanges and O-Rings.
Write, wire or phone us about your packing problems or needs . . . or for a quotation. Ask for your copy of Page's Packing Manual.
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Engineered to do a better job

BRIEFS continued

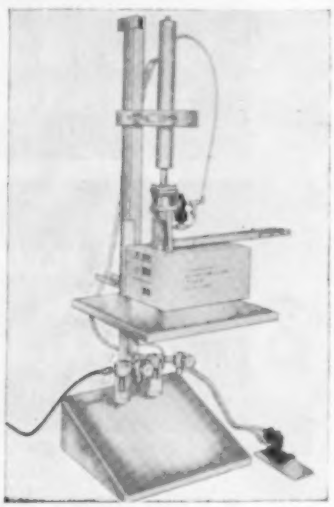
presses the prop, simulating roof load, and the thrust is gaged in tons.

• **Roof testing**—A dynamometer was developed by Dowty for recording physical characteristics and changes of the roof and floor at the coal face. This data is very valuable in scientific roof control. Basically, this unit is a hydraulic prop equipped either with a scale for reading floor penetration and convergence, or with a fully automatic recording device to keep a continuous record of roof loadings on a time-based chart.

JOHN A. LANKESTER
European Editor
▼▼▼

Air-Operated Stapler Speeds Carton Closing

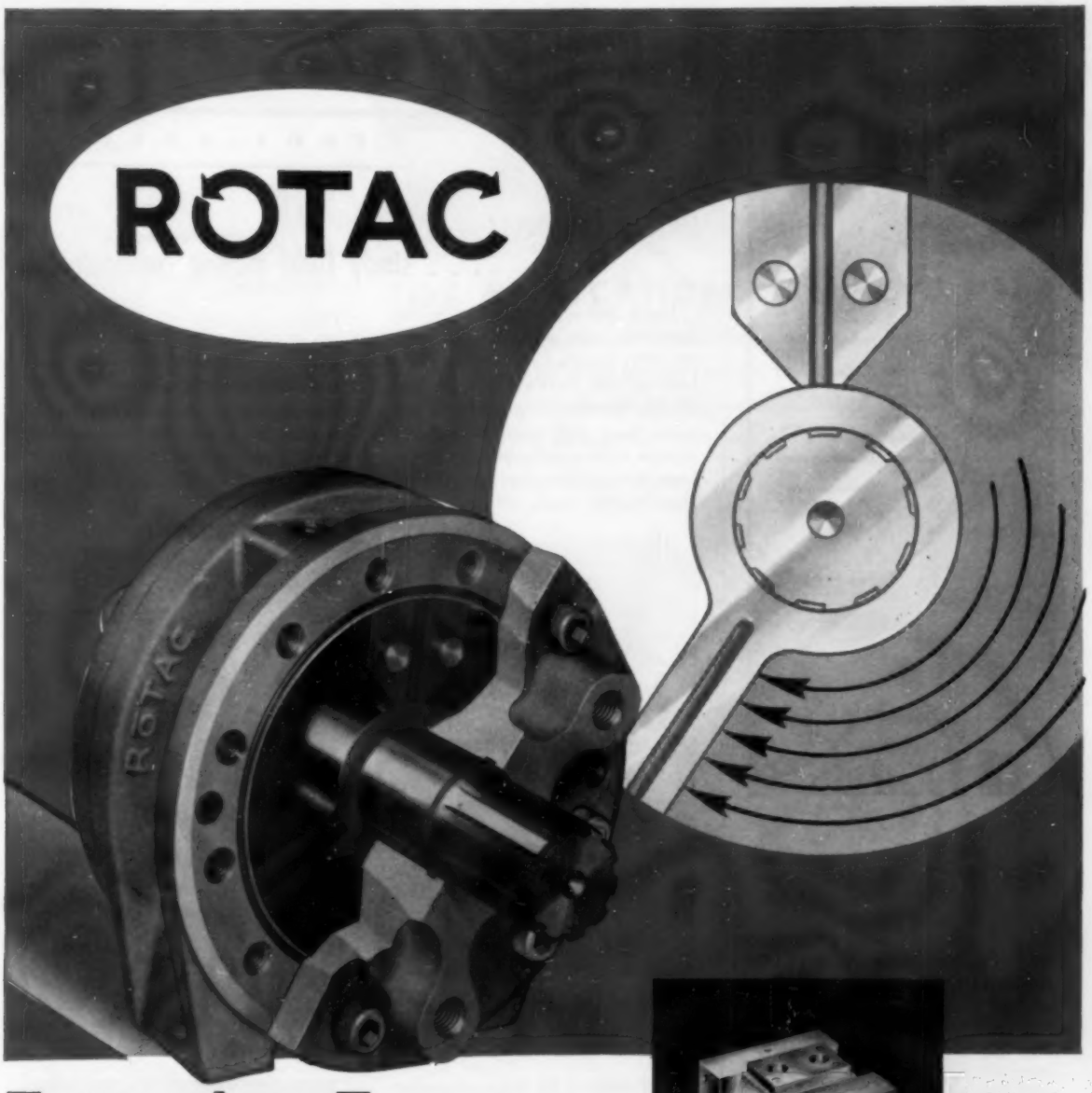
Taking advantage of the flexibility and speed of pneumatic operation, Container Stapling Corporation, Herrin, Ill., designed this machine with only six moving



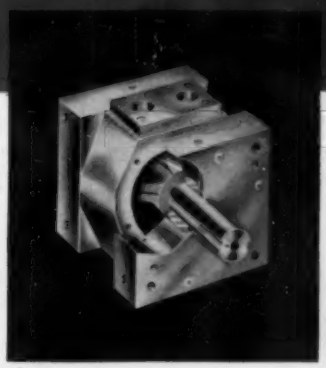
units in the stapling head, to drive 2400 to 3600 staples per hour.

• **Pneumatics**—The stapler uses air controls and the air valves are operated by completely mechanical means. Unit is fully equipped with air filters, regulators, lubricators and gauges. Air circuit operates at 60 psi, and the only connection required is to the compressed air supply. ▼▼▼

Continued on page 44



Tremendous Torque in Small Space



If you are at all concerned with an operation involving power transmission, you owe it to yourself to investigate this new name in reciprocating torque actuators: Rōtac.

The name, Rōtac, may be unfamiliar to you because of its very newness—but the name (and reputation) of Ex-Cell-O should excite your interest. Even now, Rōtac reciprocating torque actuators are performing such operations as clamping, indexing, lifting, revolving, lowering, extending, retracting, closing, opening, oscillating and turning, on a wide variety of machinery.

FREE LITERATURE

If you move *anything*, then you'll want detailed information on Rōtac. Learn how this rotary power is used throughout industry in thousands of applications. Complete with photos, schematics, engineering data, etc. 57-59

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EX-CELL-O FOR PRECISION

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EX-CELL-O PRECISION PRODUCTS INCLUDE: MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

On to Chicago...

The October Issue of APPLIED HYDRAULICS will have complete, exclusive program coverage . . . with abstracts of papers . . . on the 13th Annual National Conference on Industrial Hydraulics. It will also feature articles winning the 3 Top Prize Awards in the 5th Annual Contest sponsored by APPLIED HYDRAULICS. Don't miss it!

OCTOBER ISSUE

Applied Hydraulics

Advertisers:

This special issue means heightened interest for your sales message. Forms close September 5th . . . regular space rates apply . . . order your advertising space today!

BRIEFS continued

Design Engineers

. . . study fluid power components

Fluid power component manufacturers were well represented at the 1957 Design Engineering Show held at New York's Coliseum May 20-23. Nearly 20 percent of the more than 350 exhibits featured pumps, valves, cylinders, packings, hose, fittings and other components close to the hearts of fluid power people. Many other areas of interest such as electrical controls, motors, belts and shaft couplings were also there to make it possible to select just about everything needed for a new design from the three floors of exhibit booths. Traffic was heavy for all four days as . . .

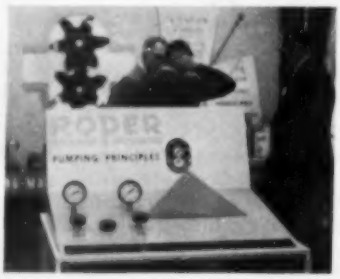
. . . they discussed packings . . .

. . . and seals with people such as E. F. Houghton Co., Garlock Crane, National Seal, and others of the more than 12 exhibitors of these components.

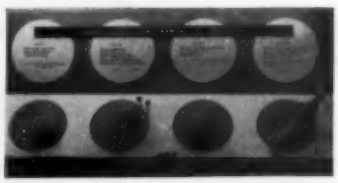
Exhibits included complete displays of packings, setups demonstrating how they work and illuminated displays to show sealing principles as illustrated here by photos of the Chicago Rawhide Mfg. Co. and Raybestos-Manhattan Inc., Packing Div. Booths.

. . . operated pumps and valves . . .

. . . displayed by many manufacturers including Atkomatic Valve Co., Automatic Switch Co., Benton Harbor Engineering Works, Hoke, Oilgear, Stratos, Valcor and Skinner Electric Valve Div. Many of these exhibits included operating displays for those who like to see things happen.



Operating cutaways of their gear pumps were featured at the Geo. D. Roper Co. booth. One display had pressure gages on inlet and outlet sides of the pump as well as restrictor valves to demonstrate the dangers of pump inlet line restriction and the ensuing cavitation.



Pumps, valves, motors and cylinders were spotlighted at the Commercial Shearing and Stamping Co. booth. There was also a complete hydraulic circuit in clear plastic. To make it possible to follow the flow, air was introduced into the system.

. . . checked fittings . . .

. . . at booths of the Imperial Brass Mfg. Co., Parker Appliance Co., The Weatherhead Co. and others. New straight thread designs and

In addition to the complete display of fittings at the L & L Mfg. Co. booth, they had a display to demonstrate the amount of flexing their fittings could take.

cluster fittings were on display. Techniques of assembly were discussed.

. . . looked at air motors . . .

. . . and a variety of other pneumatic components such as valves, cylinders and compressors displayed by Bellows Co., Leiman Bros. Inc., A. Schrader's Son, Div. Scovill Mfg. Co., and others. Several of the booths had operating

A large, illuminated, operating display at the Gast Mfg. Co. booth showed how their air pumps and motors work. Several units were in operation. Visitors studied Gast's interesting air motor applications booklet.

displays which attracted engineers to try their hand at operating a valve and watch a cylinder in action.

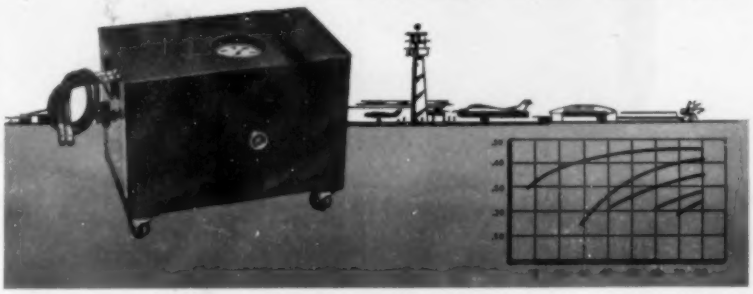
Sorry we can't tell you all about everything at the show of interest to fluid power people. There was just too much. In addition to those things we've mentioned, there were hose, filters, tubing, drive belts, electric motors, flexible couplings, electrical controls, hardware and all the other things that go into a complete hydraulic or pneumatic system. ▼▼▼

COMPACT AND EFFICIENT
HYDRAULIC POWER UNITS

FOR APPLICATIONS TO 3000 PSI

The operating characteristics are interesting and one or both of these units may be able to do a specific job for you. Each unit is completely proven and has been skillfully designed for varied utilization, low cost, simplicity of operation and maintenance, and ease of transportation.

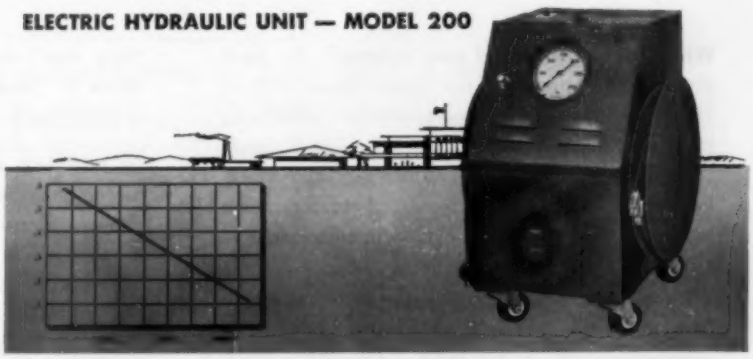
AIR HYDRAULIC UNIT — MODEL 100



This unit is explosion proof and features a demand system with constant pressure to 3000 psi. Pressure is accurately adjustable to 25 psi, the system is filtered and is powered by a piston-type, air-hydraulic booster pump incorporating an automatically operated air selector valve. All parts are commercially available.

SPECIFICATIONS:
Dimensions—19½" x 11¾" x 14" high.
Weight—75 pounds.
¼" pressure and return hoses, ⅜" air supply hose and 1 gallon reservoir.

ELECTRIC HYDRAULIC UNIT — MODEL 200



This 110V ac or dc unit features a demand system with constant pressure to 3000 psi. Pressure is accurately adjustable to 25 psi, the system is filtered and is powered by a high-speed, high efficiency gear pump. All parts are commercially available.

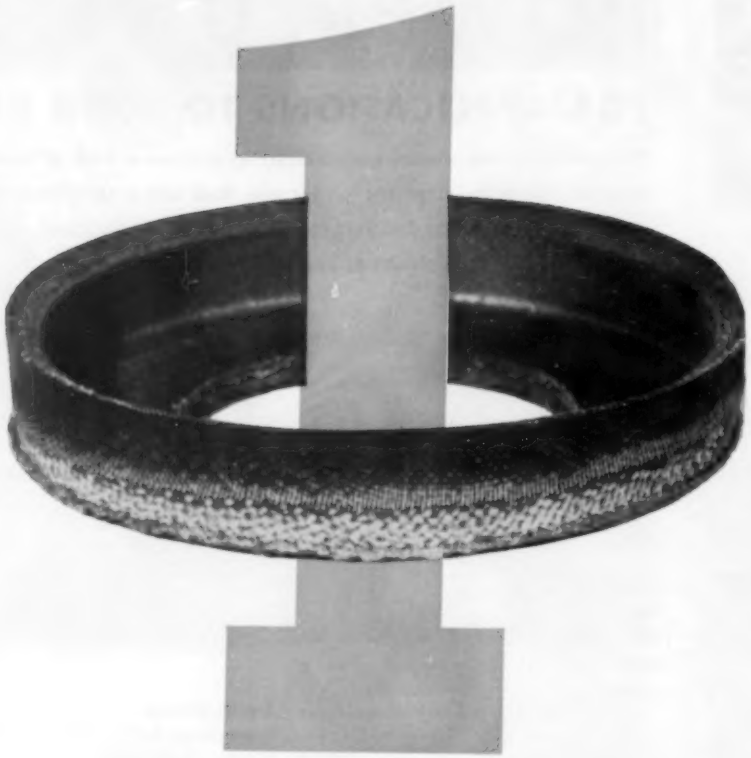
SPECIFICATIONS:
Dimensions—16¼" x 14¼" x 23" high.
Weight—85 pounds.
¼" pressure and return hoses, 110V ac or dc power, 1 gallon reservoir and ½ hp, 115V motor.

Both of these units may be modified to conform to customer specifications.

hi-shear RIVET TOOL COMPANY
2600 WEST 247TH STREET • TORRANCE, CALIFORNIA

WRITE FOR COMPLETE DATA

Which Packing



1. A run of 2,800 cycles, ended by excessive leakage, did this to a well-known make fabricated rubber packing. The test was run on a Justice testing machine at 4000 psi with a 6" stroke. Note that wear is at the heel, and that fabric is exposed and worn away.

Here's an example of Houghton's outstanding know-how

Which packing would you choose? At right you see the proof of the clear superiority of Houghton's new fabricated synthetic rubber cup packing No. 3081. After 22,000 cycles, it shows far less wear than a competitive fabricated rubber packing at 2,800 cycles. Actually, some makes lasted only 1000 cycles in this test.

Why do Houghton packings wear so much longer? First, the rubber itself has superior wear-resistance. It is a special Houghton high-density synthetic rubber. Fabric layers in Houghton packings are completely and uniformly covered with rubber. The rubber takes the wear. The fabric does *only* the reinforcing job it is supposed to do.

Because Houghton packings are pre-shaped, they don't distort under pressure. They don't have to "wear in" because they already have a pre-formed shoulder with minimum radius.

In addition, there's a PLUS feature. Instead of being surface-treated with graphite powder that wears off quickly after installation, Houghton packings are treated with a silicone lubricant to assure easy installation. It will not form valve-jamming sludge or residue in the hydraulic fluid, as graphite can.

Houghton's new #3081 packing is the hottest new development in packing science in years. Write today for Houghton's new fabricated packing bulletin—or ask the Houghton Man, the next time he calls. E. F. Houghton & Co., 303 West Lehigh Avenue, Philadelphia 33, Pa.

Ran Longer?

2. After *22,000* cycles under the same conditions, Houghton's new fabricated No. 3081 cup packing still looked like this when leakage became sufficient to stop the test. The fabric is still completely and uniformly covered with rubber, even after 19,000 cycles more wear than the other packing could deliver.

in packing science...proved in a grueling comparison test

Houghton Offers a Full Line of Hydraulic and Pneumatic Packings in a Complete Range of Outstanding Materials

"V" PACKINGS	VIM Leather • Wax impregnated • Rubber impregnated • VIX-SYN Homogeneous synthetic rubber • Fabricated synthetic rubber
"U" CUPS	VIM Leather • Wax impregnated • Rubber impregnated • VIX-SYN Homogeneous synthetic rubber
CUPS	VIM Leather • Wax impregnated • Rubber impregnated • VIX-SYN Fabricated synthetic rubber
"O" RINGS	VIX-SYN synthetic rubber

GASKETS, SEALS AND MOLDED PARTS—Rubber or Leather

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HOUGHTO-SAFE water-base and phosphate ester fire-resistant fluids • HYDROLUBRIC F. R. water-in-oil emulsion type fluid, for less hazardous applications • HYDRO-DRIVE hydraulic oil • HYDROLUBRIC additive for water hydraulic systems

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E. F. HOUGHTON & CO.

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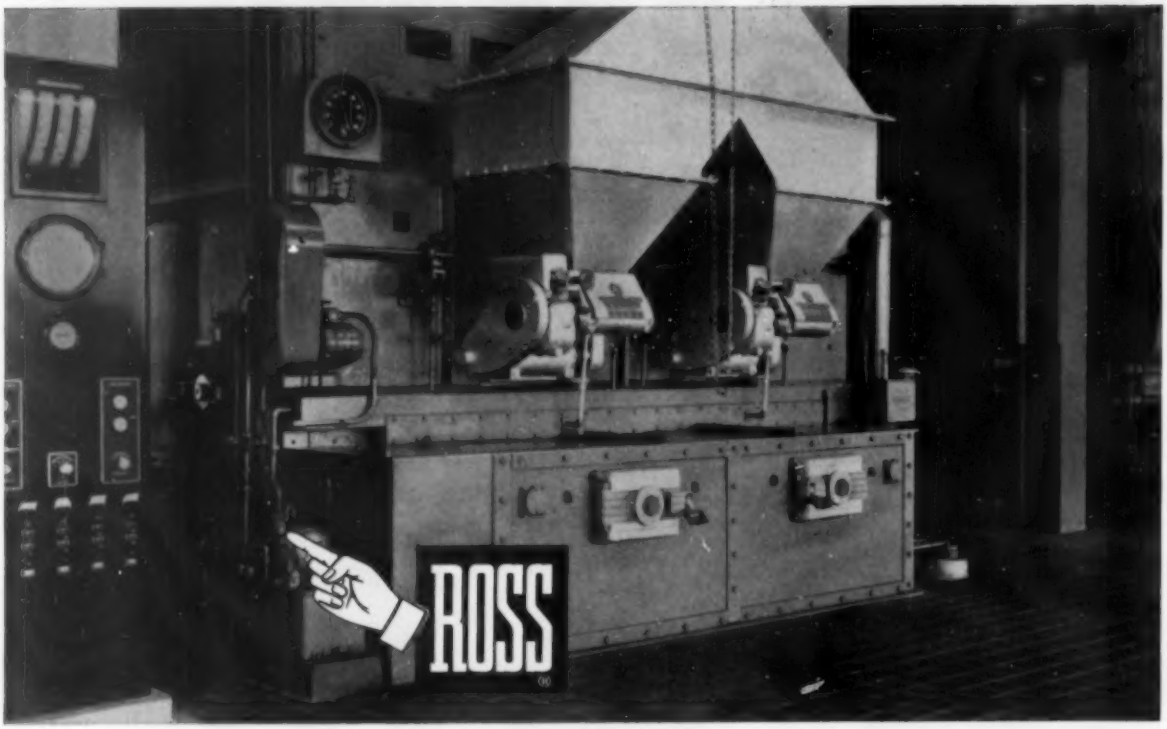
Ready to give you on-the-job service . . .

Circle 67 on Reader Service Card

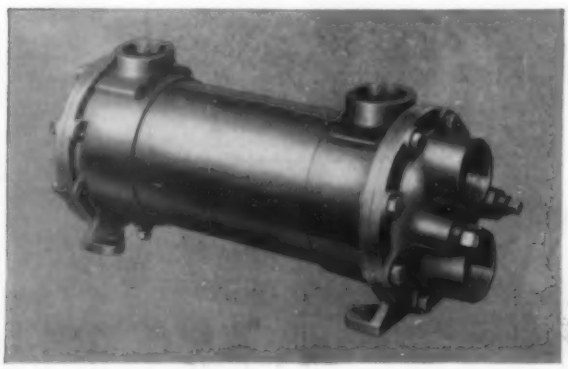
OIL COOLING BY ROSS:



Hydraulic ash discharge grate works around the clock on this AE Stoker

ONE OF FOUR INSTALLATIONS at an Ohio automotive plant, this AE Perfect Spread Stoker is under continuous operation, 24 hours a day. Serving a boiler with 80,000 lbs. per hour capacity, the hydraulically driven ash discharge grate helps deliver maximum combustion efficiency.

RUGGEDNESS AND DEPENDABILITY have made Ross Exchangers the choice to cool the hydraulic fluid here. "Ross Exchangers," says American Engineering, "are used to avoid overheating of the oil in the hydraulic system, thus assuring proper operation and maximum life of equipment."



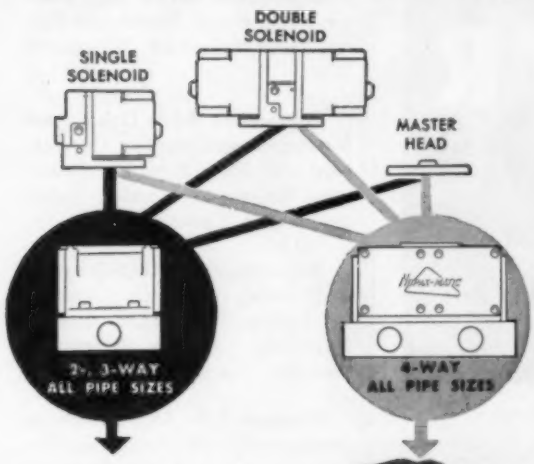
USING PAST EXPERIENCE as a basis for selection, numerous manufacturers of hydraulic equipment install Ross Exchangers with impressive regularity. They can be found wherever there is need for high thermal efficiency and the ability to withstand punishing hydraulic surges...on stretch wrap formers, die casting machines, welders, metal drawing presses, powdered metal presses, plastic molders and fluid drives.

WHY NOT look into Ross Exchangers yourself? Completely pre-engineered and fully standardized, they're available in a wide range of sizes to meet your heat transfer requirements. Request Bulletin 1.1K5 for complete details. Ross Heat Exchanger Division of American-Standard, Buffalo 5, N.Y. In Canada: American-Standard Products (Canada) Limited, Toronto 5, Ont.

ROSS HEAT EXCHANGER

Division of AMERICAN-Standard

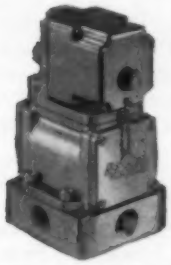
ONLY 3 PILOT HEADS fit all models



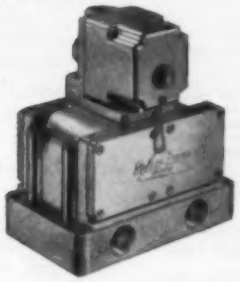
Another *Plus Value* in NOPAK-MATIC poppet-type air control valves

2-, 3-Way Master Valve

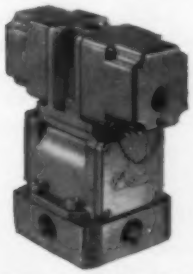
4-Way Master Valve



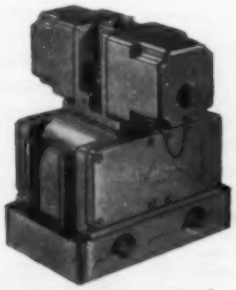
2-, 3-Way Single Solenoid Valve



4-Way Single Solenoid Valve



2-, 3-Way Double Solenoid Valve



4-Way Double Solenoid Valve

NOPAK-MATIC Plus Value Valves are available in ¼", ⅜", ½" and ¾" pipe sizes, for 2- or 3-Way Normally Open or Normally Closed or 4-Way operation with master (air), single or double solenoid pilot control heads.

Meet more air control needs with fewer valves

Nopak-matic valves, with exclusive automatic "Flow-Director" pilot heads, reduce valve and parts inventory. Fewer valves meet more application requirements.

Any pilot head (master, single or double solenoid), fits every valve regardless of type or size. Valves can be quickly converted from master to single or double solenoid control in a matter of minutes.

Other Plus Values in Nopak-matic

- 100% J.I.C. conformance at no extra cost.
- Exclusive "Flow-Director" pilot heads for more versatile application.
- Replaceable, self-cleaning seats.
- New, fast-maintenance design.
- Lightweight, corrosion-resistant construction.
- Split second response — Full flow.

Get the Full Story!

SEND FOR CATALOG 105. It describes in detail all the NOPAK-MATIC Plus Values, and contains complete installation, dimension and parts data.

Specify **NOPAK** **VALVES and CYLINDERS**

GALLAND-HENNING NOPAK DIVISION • 2743 South 31st St. • Milwaukee 46, Wis.

Here it is . . .
THE NEW
FLODAR
Metal-to-Metal
Seal
. . . A Straight Thread Port
Obsoleting Ordinary O-Rings
• Eliminates O-Ring
• Saves Space for Multiple Connections
• No Grinding or Special Seat Finishing Required—Coins own seat against machined step
• Requires No Special Tools
• Stationary Body Permits Lines to Remain Attached
• Unaffected by Temperature Extremes
• Permits Straight Line Connections
• All Conventional Shapes
Permits side-by-side installations on subpanels—without special tools—with ½" or less center-to-center spacing as shown.
Repeated installation or removal—with ordinary wrench—doesn't disturb hydraulic lines or fittings, and seal coins its own seat when nut is tightened.

PERMITS 'GANGING' OF FITTINGS

Machinery manufacturers can now design their product with all hydraulic connections concentrated in small space. One-half inch fittings, for example, can be located with one-inch or less center-to-center intervals for pumps, valves, panels etc. Cuts time, labor and maintenance costs.

REQUIRES NO SWIVELLING RADIUS

Because only the Floating Nut is tightened or loosened, no fitting swing is required. This permits snugging the fittings side-by-side in extremely small areas heretofore impossible. Even the lines can remain stationary during installation or removal.

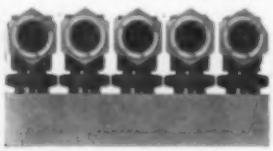


Illustration shows how compact, side-by-side installation runs were made by one large hydraulic equipment manufacturer.

WRITE FOR OUR NEW Metal-to-Metal Seal CATALOG MS-57

Ask Your Supplier to Furnish METAL TO METAL SEAL FITTINGS On Your Hydraulic Equipment

Performance-Proved by Manufacturers and Users

FLODAR CORPORATION

16911 St. Clair Avenue
CLEVELAND 10, OHIO

Future Events

September 9-12: SAE Tractor Meeting and Production Forum, Hotel Schroeder, Milwaukee, Wis.

September 9-13: 12th Annual Instrument Automation Conference and Exhibit of The Instrument Society of America. Public Auditorium, Cleveland, Ohio.

September 30-October 5: SAE Aeronautic Meeting, Aircraft Production Forum and Aircraft Engineering Display. Hotel Ambassador, Los Angeles, California.

October 1-5: SAE Aeronautic Meeting, Aircraft Production Forum and Aircraft Engineering Display, The Ambassador, Los Angeles, Calif.

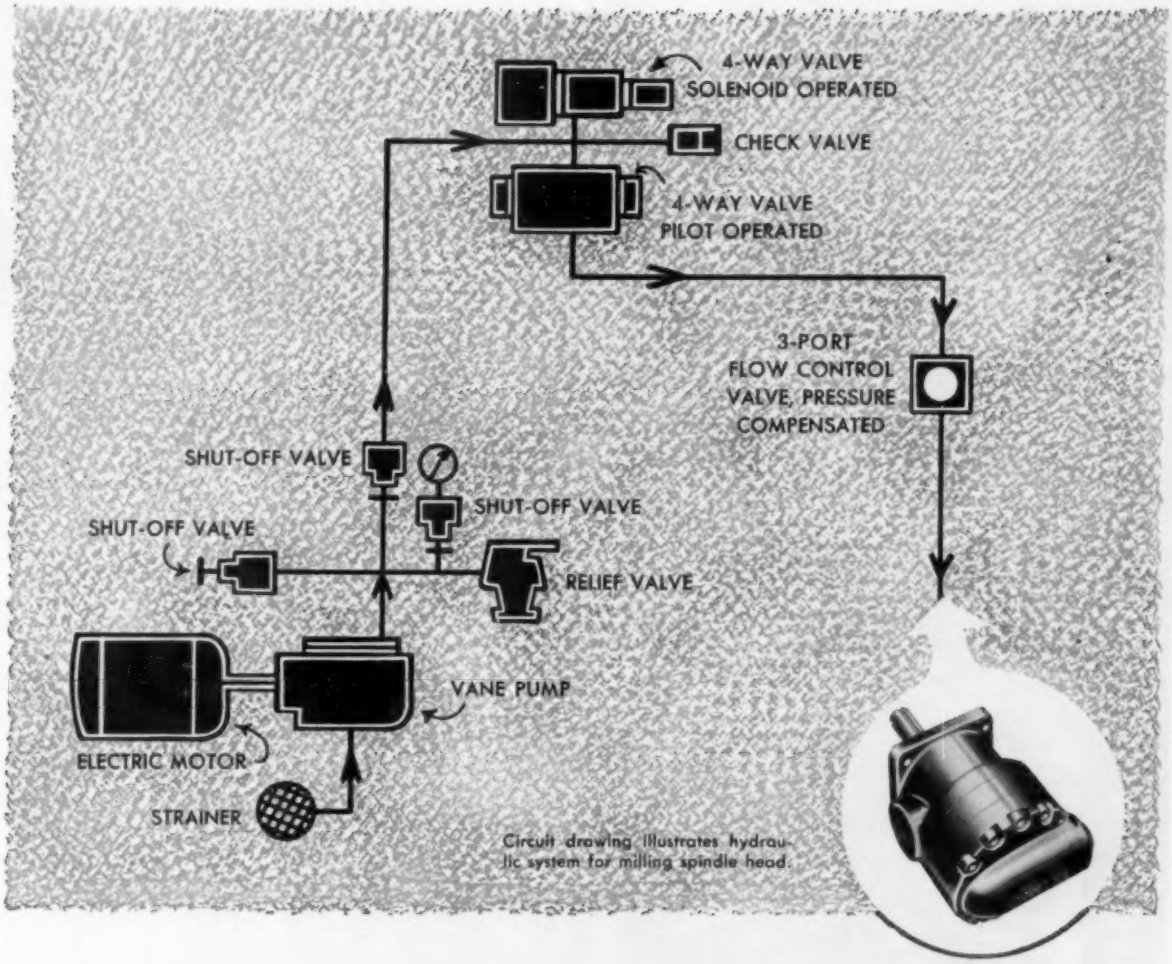
October 17-18: The 13th Annual Conference on Industrial Hydraulics. Hotel Sherman, Chicago, Illinois. Raymond D. Meade is Conference Secretary.

October 23-25: Fall meeting National Fluid Power Association, Washington, D. C. For details write: Barrett Rogers, NFPA, 1618 Orrington Ave., Evanston, Illinois.

October 31-November 2: National Conference "Engineering and Scientific Education—Foundation of National Strength", sponsored by the Western Society of Engineers, Engineers Joint Council, the Scientific Manpower Commission, the National Science Foundation and the National Academy of Sciences—National Research Council. Edgewater Beach Hotel, Chicago, Illinois.

November 13-15: Eighth National Conference on Standards and 39th Annual Meeting of the American Standards Association. St. Francis Hotel, San Francisco, California.

January 13-17, 1958: SAE Annual Meeting and Engineering Display, The Sheraton-Cadillac and Statler Hotels, Detroit, Michigan.



Circuit drawing illustrates hydraulic system for milling spindle head.

Developing a compact, efficient spindle head

...another application for Denison hydraulic power

Denison hydraulic motor is mounted directly to gear case of spindle and powers driver gear of the gear train.

THE PROBLEM: to develop a compact, efficient milling spindle head with infinitely variable spindle speed and instantaneous speed selection.

For True-Trace Sales Corporation of El Monte, California, the solution involved the use of hydraulic power... and Denison hydraulic equipment.

The result was spindle with a 15 hp rating and speeds up to 3000 RPM. To drive the spindle, True-Trace selected a Denison TMC-3 fluid motor. Variable speed control is achieved with a Denison 3-port flow control valve. The control's nine separate ranges permit exact speed selection by the operator.

Let a Denison hydraulic specialist help you with your design problems. Write Denison Engineering Division, American Brake Shoe Co., 1166 Dublin Road, Columbus 16, Ohio.

HYDRAULIC PRESSES • PUMPS • MOTORS • CONTROLS

DENISON Hydr-Oil-ics

IF IPC designed these Oil Seals for your application, you can be sure that every one will give the maximum in service. That's "custom control" . . . IPC's watchword in packings or oil seal manufacture.

Specialized engineering, custom compounding, rigid manufacture and 100% inspection guarantee such results!

Your oil seals require a *custom* approach since different applications impose different demands on oil seal performance. IPC will help you solve your problems at the design stage . . . follow through by controlling manufacture and inspection. Take your toughest "nut" to IPC.

IPC

Packings
Oil Seals
Precision Molding

INTERNATIONAL PACKINGS CORPORATION

Bristol, New Hampshire

BONDED BY IPC

1. Bonded Washer Seal Double Lip Wiper
9. Bonded Case Seal Straight Lip With Garter Spring
2. Bonded Case Seal Double Lip Wiper
10. Bonded Case Seal Limited Contact Lip With Garter Spring
3. Bonded Washer Seal Straight Lip
11. Bonded Case Seal Straight Lip Thin Rind Type
4. Bonded Washer Seal Limited Contact Lip
12. Bonded Case Seal Limited Contact Lip Thin Rind Type
5. Bonded Washer Seal Straight Lip With Garter Spring
13. Rubber Covered Bonded Case Seal Straight Lip
6. Bonded Washer Seal Limited Contact Lip With Garter Spring
14. Rubber Covered Bonded Case Seal Limited Contact Lip
7. Bonded Case Seal Straight Lip
15. Rubber Covered Bonded Case Seal Straight Lip With Garter Spring
8. Bonded Case Seal Limited Contact Lip
16. Rubber Covered Bonded Case Seal Limited Contact Lip With Garter Spring

P4

SERVING MODERN INDUSTRY

'VSG'

Regd Trade Mark

Infinitely

VARIABLE SPEED HYDRAULIC TRANSMISSION GEARS

'VSG' Variable Capacity Pump (with neutral by-pass) for driving the input section.

Strip Processing Line at THE GLACIER METAL COMPANY LTD. WEMBLEY, MIDDX.

'VSG' Hydraulic Motor for driving the input section pinch rolls.

Parallel Hydraulic Drive by four 'VSG' hydraulic motors driving the main section pinch rolls on Strip Processing Line.

'VSG' Variable Capacity Pump for driving the coiler. Also shown are the relief valves, tank and heat exchanger.

The illustrations show the 'VSG' installation for driving the processing line in which steel strip is coated with white metal by a continuous casting process. From the coated strip, bearings and bushes are produced by pressing operations. 'VSG' units, remotely controlled from two desk panels, drive the entry section pinch rolls, the main section pinch rolls and the coiler.

VICKERS-ARMSTRONGS

Distributed in Canada through dealers by
BRANT-CANADIAN DISTRIBUTORS LTD.
Main Stocks are carried in Montreal and Vancouver

CONSOLIDATED ENGINEERS & MACHINE CO. LTD.
5645 Pare Street
Town of Mount Royal, P.Q.

BAWDEN INDUSTRIES LTD.
163-181 Sterling Road
Toronto 3, Ont.

GALBRAITH & SULLEY LTD.
1331 W. 6th Avenue,
Vancouver 9, B.C.

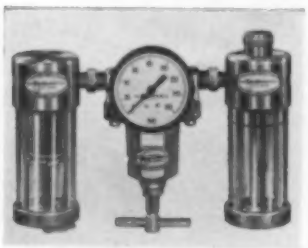
VICKERS-ARMSTRONGS (ENGINEERS) LTD · Vickers House · Broadway · London · England · Cables: Vickerseng London Telex

Circle 135 on Reader Service Card

New Products

Components, tools and equipment for fluid power systems. For more information fill in and mail post card bound in this issue.

AIR LINE FILTERS . . . for maximum efficiency



Designation: "Lubri-Air"

Features: These units filter and lubricate compressed air to insure maximum efficiency and life of pneumatic equipment. The twin baffle plates of the filter create centrifugal circulation of incoming air, forcing water and dirt particles to the base of the plastic reservoir. Any smaller dirt particles still in the air stream are then trapped by the 40 micron filter, leaving pure outgoing air. Capillary action through a porous bronze wick provides instantaneous supply of properly lubricated air, even during intermittent use. The oil-mist control regulates wick area exposed to the air stream. Port sizes of ⅛, ¼, ⅜, and ½-in. are available.

Bellows Co.
Akron, Ohio

Circle 160 on Reader Service Card

CUP PACKING . . . exhibits unusual wear resistance

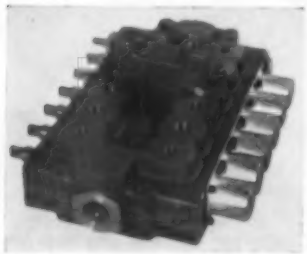
Designation: No. 3081

Features: The cup packings have almost eight times the wear resistance of standard fabricated rubber packings. They are recommended for air, water and oil service with temperatures up to 250 F. They have quick response to activating pressures. A high-density synthetic rubber covers the fabric layers. The rubber takes the wear and the fabric does the reinforcing. Available in sizes to 6¾ in. OD, they are pre-shaped and have a preformed shoulder. The packing is treated with a silicone lubricant to assure easy installation and break-in. This treatment avoids the danger of forming valve-jamming sludge or residue in the hydraulic fluid. The packing was tested on a machine with a 6-in. stroke at 4000 psi. After 22,000 cycles the packing was still useable.

E. F. Houghton & Co.
Philadelphia, Pa.

Circle 161 on Reader Service Card

CONTROL VALVE . . . for parallel cylinders



Features: The valve is designed for multiple operation of parallel cylinders where rapid operations are required. Check valves are incorporated into each plunger to prevent back flow from the cylinders when operating positions are changed. A built-in pressure relief valve prevents damage due to overloading.

Specifications: The 35 gpm 2000 psi valve has six plungers for controlling double or single acting cylinders. A cross flow double relief valve can be used with any circuit to limit individual cylinder line pressures.

New York Air Brake Company
Kalamazoo Division
Kalamazoo, Mich.

Circle 162 on Reader Service Card

For more NEW PRODUCT reviews turn to page 124

MARVEL Synclinal FILTERS

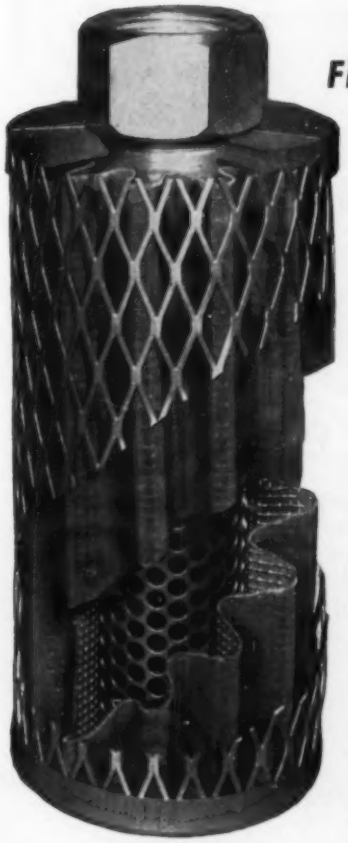
For Efficient Filtration of–

Hydraulic Oils

Fire Resistant Hydraulic Fluids

Coolants – Lubricants

Water



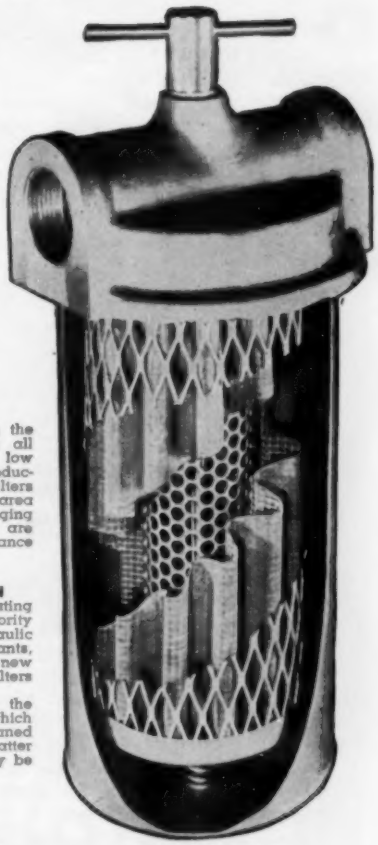
SUMP TYPE (Cutaway)

OVER 750
Original Equipment Manufacturers Install Marvel Synclinal Filters as Standard Equipment

PROTECT EQUIPMENT
INCREASE PRODUCTION
REDUCE MAINTENANCE

Marvel Synclinal Filters installed in the sump or on the line preceding pump offer maximum protection on all hydraulically actuated and other equipment utilizing low pressure circulating oil systems. Maintenance and production costs are reduced because Marvel Synclinal Filters BALANCED design offers greater ACTIVE filtering area with sufficient storage capacity for filtered out damaging particles, thus, longer periods of productive operation are attained at minimum "down-time" due to maintenance and repairs.

PRODUCTION ENGINEERS AND MAINTENANCE MEN whose job it is to keep production machinery operating at peak efficiency and who have recognized the superiority of Marvel Synclinal Filters in the filtration of hydraulic oils, fire resistant hydraulic fluids, coolants, lubricants, etc. are specifying Marvel Synclinal Filters on all new equipment and standardizing with Marvel Synclinal Filters on all machines within their plants.
Another outstanding reason for their preference is the simple construction of Marvel Synclinal Filters which allows them to be easily disassembled, thoroughly cleaned and reassembled on the spot, by any workman in a matter of minutes. Line type operates in any position and may be serviced without disturbing pipe connections.



LINE TYPE (Cutaway)

Meet J.I.C. Standards

A SIZE FOR EVERY NEED

Available for sump or line installation in capacities from 5 to 100 G.P.M. Greater capacities may be attained by multiple installation (as described in catalog). Choice of Monel mesh sizes range from coarse 30 to fine 200.

IMMEDIATE DELIVERY!

Catalogs contain complete engineering data and dimensional charts making it easy to order a filter for your specific requirements and get immediate delivery.

Catalogs containing complete data available on request

MARVEL ENGINEERING COMPANY
7227 N. Hamlin Ave., Chicago 45, Ill. **PHONE: Juniper 8-6023**

Without obligation, please send me complete data on Marvel Synclinal Filters, as indicated: (AH-7)

- ☐ Catalog #100—For Hydraulic Oils, Coolants, Lubricants.
- ☐ Catalog #200—For Fire-resistant Hydraulic Fluids (Aqueous Base)
- ☐ Catalog #400—For Fire-resistant Hydraulic Fluids (Synthetic)
- ☐ Catalog #301—For Water

Name _____ Title _____
Company _____
Address _____
City _____ State _____

Useful Literature

For your free copy of publications reviewed, fill in the reader service card

HYDAULIC POWER UNITS . . . produced by Oil-Dyne, Inc., Chicago, are described in their 52-page catalog. Also covered are pumps, cylinders, pressure switches and accessories. Complete information is given on units for pressures up to 3000 psi, with peaks up to 5000 psi.

Circle 220 on Reader Service Card

LARGE CYLINDERS . . . and other heavy duty hydraulic equipment is manufactured by Benjamin Lassman & Son, Glenshaw, Pa. Bulletin illustrates unusual equipment manufactured, including a 4-in. 22-ft stroke cylinder; 6-gal., 3500 psi intensifier; 19½-in. bore balance cylinder; and a 14¼-in. bore, 15-ft. stroke, 2000 psi cylinder for casting ingots.

Circle 221 on Reader Service Card

HYDRAULIC GEAR PUMPS . . . featuring the gerotor principle for reducing shock and turbulence, are manufactured by Gerotor May Corp., Baltimore, Md. Bulletin G-110-A describes and illustrates the gerotor principle and gives details and specifications on three pump types.

Circle 222 on Reader Service Card

OIL SEALS . . . are listed in 68-page condensed Catalog 856-C published by Chicago Rawhide Mfg. Co., Chicago. Included is a complete section describing and illustrating the various materials available for use as sealing members. A chart indicates the compatibility of each material with a wide range of media to be sealed.

Circle 223 on Reader Service Card

MAINTENANCE HANDBOOK . . . briefly and clearly gives procedures for installing hydraulic and pneumatic systems. After the installation is made, it tells what to look for if the system fails to function properly. Entitled "The Facts of Life on Air & Hydraulic Devices," the 18-page, pocket-size booklet is available from Logansport Machine Co., Inc., Logansport, Ind.

Circle 224 on Reader Service Card

PRESSURE TUBING . . . is the subject of bulletin BR-3A from The Polymer Corporation of Pennsylvania. The bulletin describes the characteristics and installation advantages of flexible polyamide tubing along with available sizes and information on where to use it. Also included are pictures and operating instructions for the installation tools designed for use with Nylaflow tubing.

Circle 225 on Reader Service Card

FLUID CONTROL VALVES . . . for air or hydraulic service, are described in Bulletin 57 issued by Modrich Fluid Controls, Inc., Crystal Lake, Ill. Complete specifications are given on flow control, check and needle valves in the line, along with schematic drawings showing their operation.

Circle 226 on Reader Service Card

ROTARY ACTUATORS . . . hydraulic pumps, dampers and other products for aircraft service, manufactured by Houdaille Industries, Inc., Buffalo, N. Y., are illustrated and described in a 4-page bulletin. Line covers equipment for vibration control of all types, including such items as helicopter rotor and landing gear dampers and linear rotor-blade lag dampers.

Circle 227 on Reader Service Card

PRESSURE REGULATORS . . . and temperature regulators, manufactured by Manning, Maxwell & Moore, Inc., Stratford, Conn., are described in Bulletin 112C. A feature of this bulletin is three convenient tables showing valve sizes and factors to consider in choosing the proper size valves.

Circle 228 on Reader Service Card

WELDED BELLOWS . . . in stainless steel and similar alloys are produced by The Belfab Corp., Agawam, Mass. Catalog 2 gives complete design information and engineering data.

Circle 229 on Reader Service Card

HOSE FITTINGS . . . for marine applications are covered in Catalog 301 published by Aeroquip Corp., Jackson, Mich. Material is presented in convenient, time-saving manner, covering 54 pages of planning information, bend radii data, pressure data and other engineering information.

Circle 230 on Reader Service Card

CUSTOM MOLDED PARTS . . . are described in 3-piece literature kit available from Stillman Rubber Co., Culver City, Calif. Literature provides complete information on commercial and military O-rings, rubber-to-metal bonding process, and facilities available.

Circle 231 on Reader Service Card

For more reviews of FREE LITERATURE turn to page 144

*Snap-Tite

QUICK-CONNECT

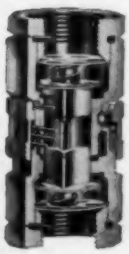
QUICK-DISCONNECT COUPLINGS

in larger sizes

immediate delivery
FROM FACTORY STOCKS

SNAP-TITE'S "H" COUPLING, SIZE FOR SIZE, IS THE SMALLEST COUPLING WITH HIGHEST STRENGTH AND HIGHER EFFICIENCY

Snap-Tite's "H" Couplings are now factory-stocked for quick shipment to you, not only in the smaller sizes (below 1" ID) but in all sizes up to and including 3"—in steel, brass, aluminum, and 303 and 316 **Stainless Steel.** And "H" Couplings can be made to your order, up to 10" ID.



Available with valves to give two-way or one-way automatic line shut-off, or without valves for straight-thru flow, "H" Couplings are built to handle high pressures in hydraulic and air systems.

Recessed valve washers . . . fluted valve stems . . . valve stops with minimum flow restrictions . . . large inside diameter—allow maximum flow capacity with lowest pressure drop.

See the Snap-Tite representative in your city or write for Bulletin 240.

*Snap-Tite, INC.

UNION CITY 1, PENNSYLVANIA

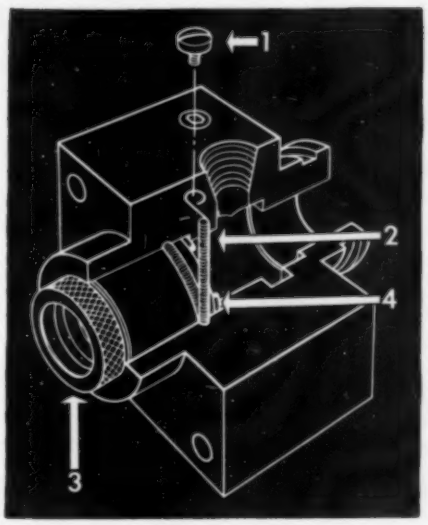
SNAP-TITE COUPLINGS CAN HANDLE ALMOST ANYTHING THAT FLOWS

Minute Maintenance
CUTS COSTLY DOWNTIME . . .

EASY DOES IT WITH A LINDBERG "S" LINE CYLINDER WITH THE "QUICK CHANGE" FEATURE

Newest addition to a proven line . .

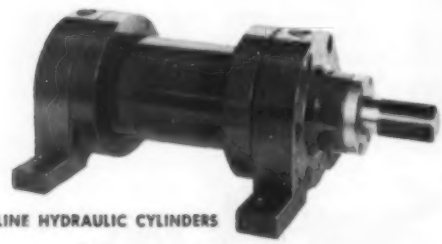
Member N.F.P.A.



That's right, with a Lindberg "S" Line cylinder you can replace, if necessary, "U" cup Rod Packing, "U" cup Wiper, Cartridge Seal or the entire Rod Cartridge Assembly *in minutes*, without special tools or equipment.

HERE'S HOW: Remove Retaining Screw (1) (see cutaway, right) • Strip out Rod Cartridge Retaining Spring (2) • Twist Rod Cartridge (3) to free from Rod Cartridge Seal (4) and withdraw from Rod End Head • Reverse procedure to assemble and you're back in business—without a long, costly delay.

"S" Line cylinders last longer too. Chrome plated steel tube honed mirror bright • Chrome plated manganese steel Piston Rod • Tie Rods—pre-stressed to carry equal load • Full floating cushions • 23 other soundly engineered features mean extra life and lower per hour cylinder costs for you. 7 bore sizes to 6" —Rated 250 psi pneumatic, up to 1000 psi hydraulic—Mounting styles to fit your needs—Standardized mounting dimensions—Built to JIC recommendations. Send today for your copy of Bulletin S-101 on Lindberg Squarehead "S" Line Cylinders.



"H" LINE HYDRAULIC CYLINDERS

OTHER VERSATILE LINDBERG CYLINDERS

2000 PSI "H" LINE—Hydraulic—Shown left, bore sizes up to 8", with or without cushions, standard or 2:1 rods, mounting styles to fit your needs • "A" LINE—Air or Hydraulic—A rugged, non-tie rod cylinder for air pressures up to 150 psi and low pressure hydraulic service • MILL TYPE AND OTHER SPECIALS—For information, send outline of your requirements.

Write for free literature and the name of our representative near you.

TEER-WICKWIRE & CO.

LINDBERG AIR AND HYDRAULIC DIV. • 1802 WILDWOOD AVE., JACKSON, MICHIGAN

BUILT BY ENGINEERS
WHO SPECIALIZE IN . . .

FLOW REGULATORS

Waterman Engineering Company has furnished thousands of flow regulators to all types of industries with growing satisfaction.

Their experience in this field is most valuable in accumulating a fund of data on flow control applications. Waterman offers you this experience in solving your flow control problems. Only a few of Waterman models are shown on this page.

Write for latest bulletin A

WATERMAN ENGINEERING COMPANY

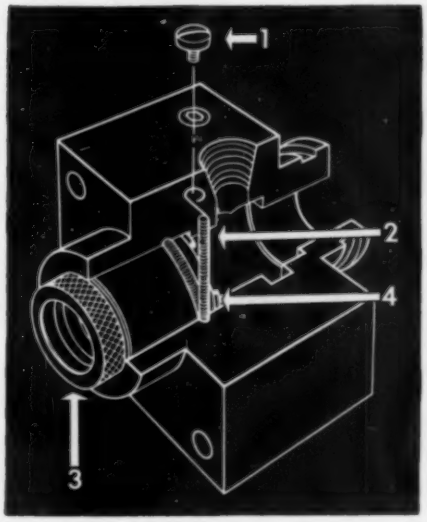
725 CUSTER AVENUE • EVANSTON, ILLINOIS

Minute Maintenance
CUTS COSTLY DOWNTIME . . .

EASY DOES IT WITH A LINDBERG "S" LINE CYLINDER WITH THE "QUICK CHANGE" FEATURE

Newest addition to a proven line . .

Member N.F.P.A.



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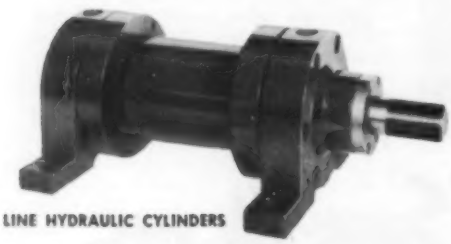

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Write for free literature and the name of our representative near you.

TEER-WICKWIRE & CO.

LINDBERG AIR AND HYDRAULIC DIV. • 1802 WILDWOOD AVE., JACKSON, MICHIGAN

BUILT BY ENGINEERS
WHO SPECIALIZE IN . . .

FLOW REGULATORS

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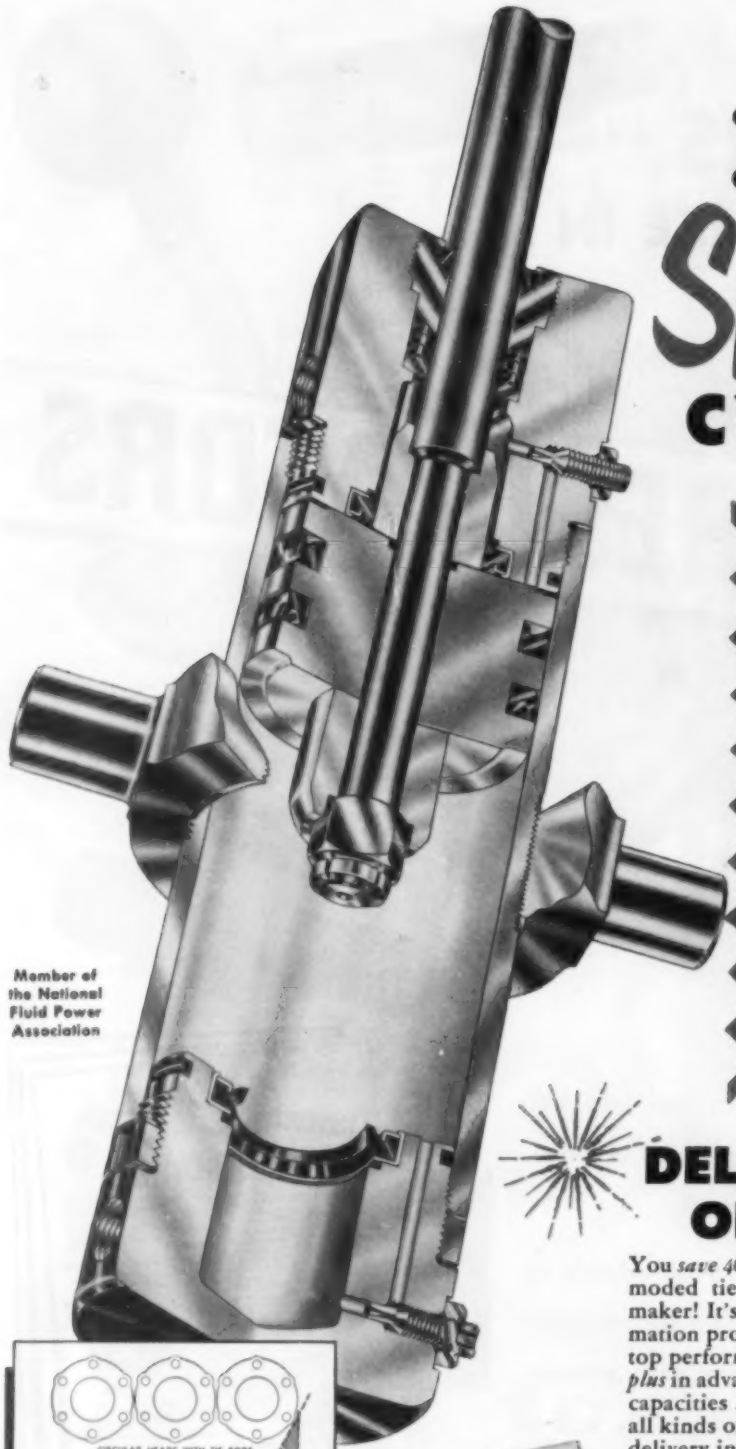
Their experience in this field is most valuable in accumulating a fund of data on flow control applications. Waterman offers you this experience in solving your flow control problems. Only a few of Waterman models are shown on this page.

Write for latest bulletin A

WATERMAN ENGINEERING COMPANY

725 CUSTER AVENUE • EVANSTON, ILLINOIS

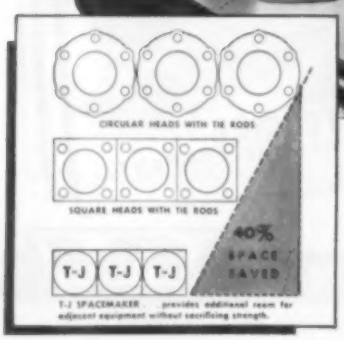


Member of the National Fluid Power Association

all the EXTRAS are standard with

T-J Spacemaker CYLINDERS

- **NEW** *exclusive* ingenious cushion designs . . . Super Cushion Flexible Seals for Air . . . New Self-Aligning Master Cushion for Oil.
- **STRONGER** than outmoded tie rod design, proven through actual tests. No tie rods to stretch.
- **SOLID STEEL HEADS** throughout the full line.
- **COMPACT DESIGN** eliminates tie rods, increasing the strength and reducing mounting space required, providing extra room for adjacent equipment.
- **HARD CHROME PLATED** body bores and piston rods . . . assure you of long trouble-free service. (Standard at no extra cost.)
- **METALLIC ROD SCRAPER,** not just a wiper, actually removes foreign matter from the rod.
- **PILOTED PACKING GLAND** with extra long bearing. Additional strength and support to the piston rod.
- **OIL** pressure to 750 p.s.i. AIR to 200 p.s.i.



T-J SPACEMAKER . . . provides additional room for adjacent equipment without sacrificing strength.

DELIVERY OFF THE SHELF!

You *save 40% space* when you switch from outmoded tie rod cylinders to the T-J Spacemaker! It's stronger, too! Fits right into automation programs in countless plants. Delivers top performance and dependability with a big *plus* in advanced features. Wide range of styles, capacities . . . reduces man-hours and costs in all kinds of push-pull-lift operations. Off-shelf delivery in 64,000 combinations!

NEW LITERATURE—Send today for new Catalog SM56 with complete engineering details on Spacemaker line. Write The Tomkins-Johnson Co., Jackson, Mich.

T-J TOMKINS-JOHNSON

VALVES . . . AIR AND HYDRAULIC CYLINDERS . . . CUTTERS . . . CLINCHERS

FLUID POWER *Pioneers*

STANLEY H. DURBIN

E. W. Bliss Company

Canton, Ohio

● Fluid Power Pioneers . . . are selected by the editors of APPLIED HYDRAULICS to acknowledge outstanding contributions they have made in the use of fluid power to improve their company's products.

REGARDLESS of how long you've been on the job, if you have no memory, you lose your experience." This was one of the reflective statements made by Stan Durbin in reviewing his responsibilities as Associate Chief Engineer of E. W. Bliss Co. "Gaining experience is not so much a matter of spending time, as it is keeping your eyes open and learning—and then remembering what you've learned."

Stan started his experiences as an office boy in 1914 working for a manufacturer of optical supplies. Later his mechanical traits brought him a job as a lathe operator for a company making fountain pens. In 1918 Durbin went into military service as a mechanic in the Motor Transportation Corps., and on his discharge took up civilian life again as a machine operator in the Los Angeles ship yards.

Returning east in 1920, Stan joined Kent Owens Machine where he learned tool designing and later became a design engineer on machines for scoring ice. Although this type of equipment has nearly passed into antiquity, it provided Stan with the opportunity of gaining some valuable machine designing experience, and in 1932, working at home on the dining room table, he designed a machine for Gifford Woods Co. that became their largest seller.

Bliss's Brooklyn plant was the starting point of Stan's present service with the company. He was hired as assistant superintendent of that factory. One of the high points in his career came in 1937 when he took an assignment in England to supervise the installation of thirteen 2800-ton hydraulic heading presses. This required eight months to complete and gave Stan time to become acquainted with English customs and engineering methods.

After returning, he went into field service on presses, and realizing the increasing need for maintenance on complex industrial systems, he trained in troubleshooting, especially in locating faults in electrical control systems. He was responsible for the design of the electrical circuit for a six-table aircraft press, and this brought together his knowlege of hydraulics and electrical control. Stan has supervised all electrical circuit design since 1941.

As other manufacturers of large hydraulic equipment, Bliss has done much original design of valves and cylinders. How these have combined to give a high production press is explained in this month's article *Air Controls Oil Circuits.*

Uniform commercial O-rings promptly—anywhere!

National O-rings are stocked in major cities coast to coast. Large quantity orders are filled quickly from factory warehouses; smaller quantities are readily available from convenient distributor stocks. In every case, you and your customers are assured of exact uniformity in compound, finishing, durability and performance.

When special O-rings are needed, National's experienced engineers and large manufacturing facilities are at your immediate service.

Find out about National O-rings. Just call or write any National district sales office for O-ring data, engineering service, or the name of your nearest National O-ring supplier.

NATIONAL SEAL
Division, Federal-Mogul-Bower Bearings, Inc.
General Offices: Redwood City, California
Plants: Van Wert, Ohio, Redwood City and Downey, California

National District Sales Offices:

Chicago, Ill.
Room 462, McCormick Building
HArrison 7-5163

Cleveland, Ohio
210 Heights Rockefeller Bldg.
YEllowstone 2-2720

Dallas, Texas
2520 West Mockingbird Lane
FLeetwood 2-7541

Detroit, Mich.
13836 Puritan Avenue
VErmont 6-1909

Downey (Los Angeles Co.), Calif.
11634 Patton Rd.
TOpaz 2-8163

Indianapolis, Indiana
2802 North Delaware St.
WAlnut 3-1535

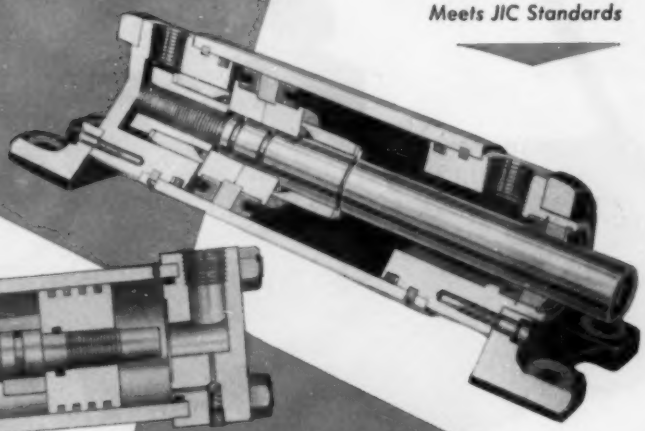
Milwaukee, Wis.
647 West Virginia St.
BRoadway 1-3234

Newark, N. J.
1180 Raymond Blvd.
MItchell 2-7586

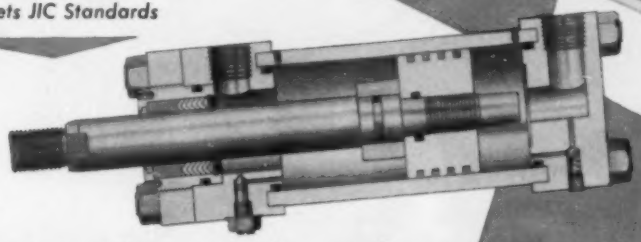
CATALOGS (F) IN SWEET'S

O-M CYLINDERS (AIR AND HYDRAULIC) have everything

O-M Tie-Rodless
150 PSI Air
Up to 1500 PSI Oil
With Internal
Locking Mechanism
Meets JIC Standards



O-M Series T-H
Hydraulic 2000 PSI
With Removable
Gland Cartridge
Meets JIC Standards



Construction and performance features that keep O-M cylinders right in the middle of AUTO-MATION

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O-M Air and Hydraulic Cylinders are available in 1½" to 8" bores with standard and heavy-duty piston rods.

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Circle 94 on Reader Service Card

Drills 417 holes at one time.

How to keep hydraulic equipment in tune

The multiple-spindle machine, shown above, is used in the production of cast iron harps for pianos. It drills 417 holes at one time—from 5/32" to 7/16". The large number of spindles makes lubrication a critical factor in keeping production humming.

That's why the machine manufacturer—Zagar Tool, Inc., Cleveland, Ohio—specifies *Texaco Regal Oil R&O* both as a spindle lubricant, and in the hydraulic system which controls the feed of the drills.

Texaco Regal Oil R&O has much greater oxidation resistance than ordinary turbine-quality oils used in hydraulic service. It effectively prevents rust and foam—assures smoother, more dependable service.

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TEXACO

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FOR ALL HYDRAULIC UNITS

Circle 123 on Reader Service Card

FABRICATING MACHINERY FORUM

ELIMINATION of shock, fluid selection and maintenance and plumbing methods were some of the factors, common to almost all hydraulic fabricating machines, discussed at the Fabricating Machinery Hydraulic Conference held in May by Vickers, Inc. Engineers representing manufacturers of presses, benders, and welders met with hydraulic component manufacturers and users. Moderating the sessions were J. R. Hemeon, hydraulic equipment engineer at Ternstedt Div. of General Motors and Otto J. Maha, vice president of Hannifin Corp. The major topics were Circuit and System Problems, Pump and Valve Design, Fluids, Maintenance, Electrohydraulic Controls, Seals and Packings, and Fittings and Plumbing. In addition to this agenda, three papers covering the hydraulic design of a welding machine, a high production automatic foundry, and the world's largest stretch forming machine were given.

...AN AH STAFF REPORT...

What Causes Pump Cavitation?

Cavitation or starving of the pump is the result of trying to move too much volume for the pump rating, using a fluid with too high a specific volume, restrictions in the pump inlet due to a clogged filter or undersized line, and too high a lift from the reservoir to the pump. These reasons were outlined by Lou Jordon, Vickers. He offered several solutions to these conditions including supercharging and the use of an overhead reservoir. Answering an inquiry from Bill Hunter of Galland-Henning about a safety device to shut off the pump in case of cavitation,

Jordan indicated sensing devices are being used to indicate clogged strainers with alarm systems to notify the operator. Cavitational noise is usually the best indicator. Allan Steel of Scovill Manufacturing suggested a negative pressure switch on the inlet as a possible alarm system.

Is vapor space erosion a problem in cavitation?

This has the effect of washing away the materials, and the high frequency vibration and shock are destructive to pump and piping. Illustrating the effects of a clogged filter, Stan Durbin of E. W. Bliss described the use of a vane pump in a deep drilling application. Tubing was continually being broken because of vibration caused by cavitaion. Filtering was a problem on this job until a separate filter was installed so that the main pump was not required to pull through the filter.

What are the effects of cavitation?

Loosening of piston rods, and damage to the inlet port bushing of the pump are two common results. Jim Robinson of Vickers added that in a vane pump the vanes bounce up and down resulting in scuffs and nicks on the cam ring as well as erosion.

What's the effect of shock loading on a pump?

Broken vanes and rotor, and excessive wear are two of the results of shock loading cited by Lou Jordan. As far as the transients set up *by* the pump, Bob Erskine said that pump ripple which depends on the number of vanes or pistons is rarely detrimental in the system.

MODERATORS FOR THE CONFERENCE were Otto Maha, vice president of Hannifin Corporation and J. Russell Hemeon, hydraulic equipment engineer at Ternstedt-Trenton Div. of General Motors. Representing a press manufacturer and a user they guided the discussion through the 2-day forum.

What is the best method for accurately dividing flows of 25 to 75 gpm?

Carl Brown of Vickers commented that the best way to divide flows in this range is to couple the drive shafts of two, fixed stroke, hydraulic motors and to pass the flows through them. He added that other methods such as valving incorporating venturies or orifices can be used, but generally they are inefficient because of the heat generated. Accuracy of positioning with coupled motors was estimated at 97 to 98%.

How do you synchronize 3 or 4 cylinders?

Here again fluid motors can be connected through gear boxes. Jordan pointed out that servo devices are being used in some applications to synchronize cylinders. The use of double ended cylinders was also indicated. Using a relief or bypass compensates for leakage differences.

What is the future for pressures beyond 3000 psi?

Users would like a 10,000-psi pump delivering 20 gpm and a 5000-psi pump for 100 gpm. Frank Mackin of General Motors Institute reported that these are being investigated. He indicated one application of 10,000 psi for piercing. There can be disadvantages to these higher pressures especially in valves. The 5000-psi, 100-gpm pump is coming soon. And the 10,000-psi pump may not be too far off.

Dick Paulton of Cincinnati Milling Machine said they are using the presently available 10,000-psi pumps and have a great use for the 20-gpm units if they could get them. For 5000 psi they're using 65-gpm pumps but would like 100 or 125-gpm units for their large presses. Paulton reported no leakage problems with these pressures because of special fittings. In fact they have more trouble at 1000 psi where commercial fittings are used.

When will 8000-psi hose be available?

Present hose specifications go only to 5000 psi with 18,000-psi burst pressure in the ⅜ size. What's needed is a large volume size of 1 inch or more for 10,000 psi. Developments are being carried out but one tough problem is in coupling. This was stated by W. A. Hertel of Weatherhead. ½-inch hose for 10,000 psi has been in long use and ¾-inch for

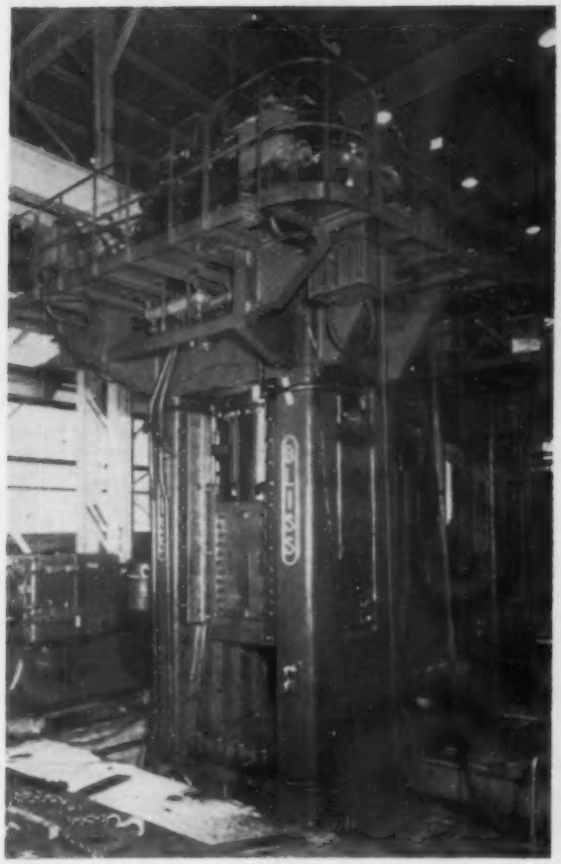
Continued on page 116

Articles on the following pages show how fluid power is being applied to improve performance of fabricating machinery.

Directional valves are air-operated and designed with light moving parts for fast action and less effect from temperature variations. The 2½-inch valves require lower cost plumbing than oil-piloted units.

AIR CONTROLS OIL CIRCUITS

. . . on a 2000-ton press



• By S. H. Durbin

PRODUCTION capacity of a press is determined by the time required for operation of directional control valves, as well as speed of the ram in approach, pressing, and return. Valve operation for reversal and speed change is especially important on fast closing presses.

Larger size control valves for automatic operation are usually actuated by an independent oil-pilot system of about 500 psi. By designing a special, balanced-piston directional control valve, engineers at E. W. Bliss Company are able to use air-pilot operation for faster action of the valves.

The 3-way directional valve is held in its normal position by air pressure and requires no springs. The 4-way operating valves are spring-centered and air-operated to direct the flow of fluid. These valves are actuated by 3-way, solenoid-operated air valves which are in turn actuated by an electrical control system using relays, limit switches, and pressure switches which sense press position and oil pressure.

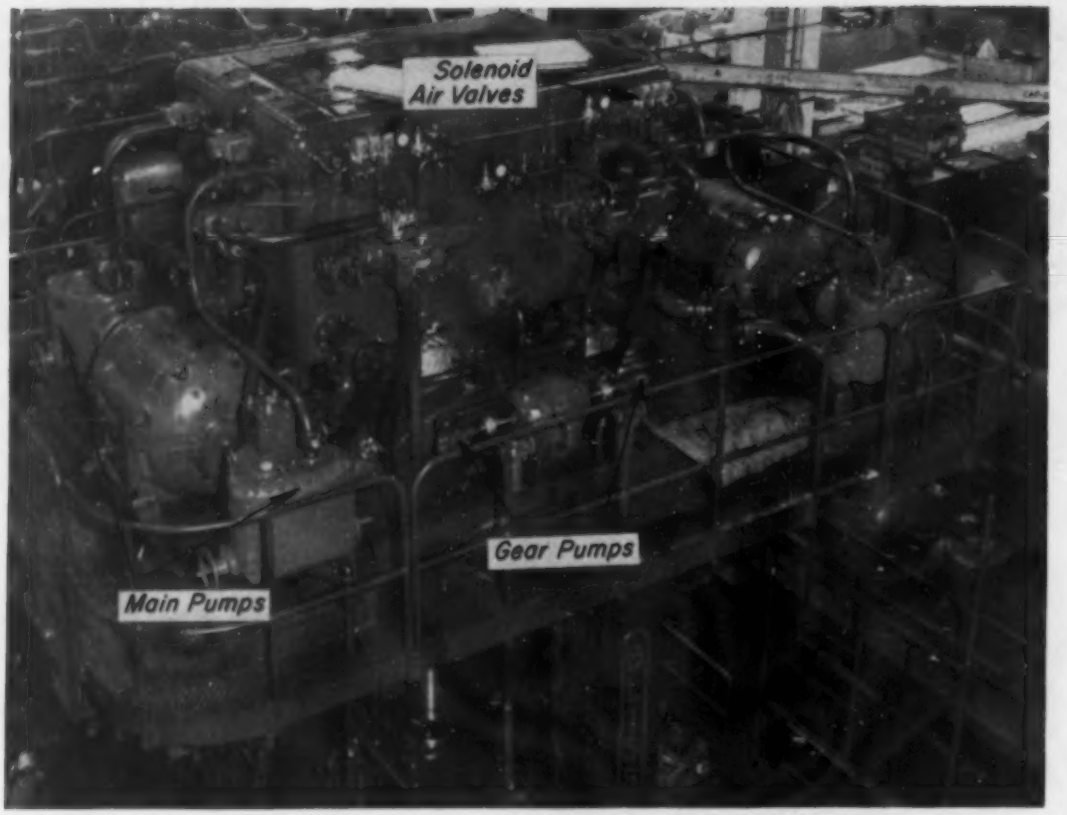
On several 2000-ton presses recently designed for cold flow, extension type forming, the cycle is:

1. Fast approach at 600 in./min.
2. Press at 60 in./min.
3. Rapid return at 600 in./min.
4. Ejection of the work during the upstroke of the press.

AIR-OIL SYSTEMS

Four, axial piston, variable delivery pumps

S. H. DURBIN, *Associate Chief Engineer, E. W. Bliss Co., Canton, Ohio*



PUMPS AND RESERVOIR are mounted on top of the press. Four variable delivery, axial piston pumps supply the system with 383 gpm.

AIR CONTROLS OIL CIRCUITS

supply the hydraulic system and are driven by two 250-hp motors with double shaft extensions. The pump displacement is controlled by a handwheel to adjust press speed. Maximum displacement of the pumps at 0-psi is 38.33 cu. in./rev. and they are set to deliver 96 gpm at 2710 psi. The relief valves limiting pressure at each pump are set at 2740 psi. Neglecting friction, the pressure requirement for a 2000-ton force on the platen would be 2710 psi in the main ram and auxiliary cylinders. The required delivery for a press speed of 60 in./min. is 383 gpm. Combined delivery from the pumps is 384 gpm.

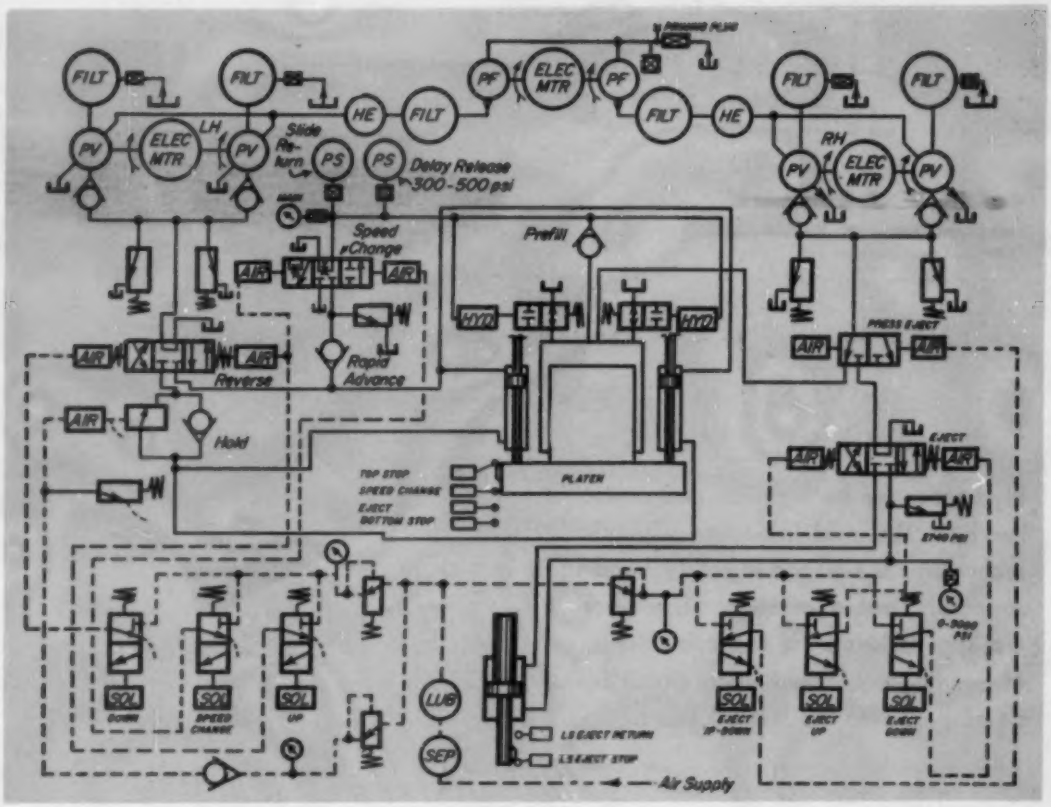
The four main pumps draw oil at head pressure from the main tank thru 4-inch screen type strainers which can be readily cleaned without draining the oil. Two 51-gpm gear pumps deliver cooled oil to the main pump slippage housings which overflow into the main tank.

The two left-hand main pumps are piped together through check valves to the 4-way reverse operating valve controlling fluid flow to the two auxiliary cylinders connected in parallel. These 8-inch cylinders have a double rod extension, so that rapid approach and return speeds are equal.

The main ram fills through two 10-inch, 2-way, pilot-operated prefill valves and a 2½-inch check valve which is connected to a cylinder from the SPEED CHANGE valve. The air-operated SPEED CHANGE valve has an integral adjustable flow control valve to decompress the main ram before raising the platen.

The two right-hand pumps are piped together through check valves to the 3-way, air-operated PRESS-EJECT valve. The valve directs pump delivery either to the main ram during rapid approach and pressing or to the 4-way, 3-position EJECT operating valve controlling the 150-ton ejector cylinder. The 11⅞-inch ejector cylinder has a rod extending from the head end for the purpose of actuating limit switches at each end of its travel to reverse and stop its motion. A relief valve in the 3-inch line to the head end of the ejector cylinder is set at 2740 psi to limit the developed pressure in case the press pushes the ejector down.

Shop air is supplied through a filter and lubricator to pressure reducing valves supplying the 3-way DOWN, SPEED CHANGE, and UP valves and the EJEC-



PRESS CIRCUIT shows controls for main cylinder, auxiliary cylinders and ejector cylinder. Sequencing of the press is controlled by limit switches which sense the position of the platen and ejector cylinder, and by pressure switches. The 35-psi check valve insures closing of the prefill valves before pressing.

TOR UP-DOWN, EJECTOR UP, and EJECTOR DOWN valves. These air off-set, solenoid-operated valves control the sequencing of the press.

PRESS CYCLE

The operating cycle is started by a pushbutton which actuates the DOWN air valve. This shifts the operating valve to direct output from the left-hand pumps to the top of the auxiliary cylinders, lowering the press platen at fast speed. As the press descends, the main ram fills through the 2-way prefill valves.

When the SPEED CHANGE limit switch is actuated on the down stroke, the SPEED CHANGE air valve is actuated shifting the SPEED CHANGE 4-way valve to direct fluid from the left-hand pumps through RAPID ADVANCE check valve. Because of the pressure required to open the spring-loaded prefill check valve, oil at approximately 35-psi is first directed to close the 2-way prefill valves. When the valves have closed, the check valve opens directing flow to the main ram. The platen is now lowered at pressing speed because all pumps are delivering to the main ram.

At the bottom of the stroke, either the SLIDE RETURN pressure switch or the BOTTOM STOP limit switch is actuated to de-energize the DOWN and SPEED CHANGE air valves. The left-hand pumps are unloaded through the operating valve while the main ram and the right-hand pumps are decompressed through the prefill valves. The opening of the prefill valves is controlled by the adjustable orifice in the neutral position of the 4-way SPEED CHANGE valve.

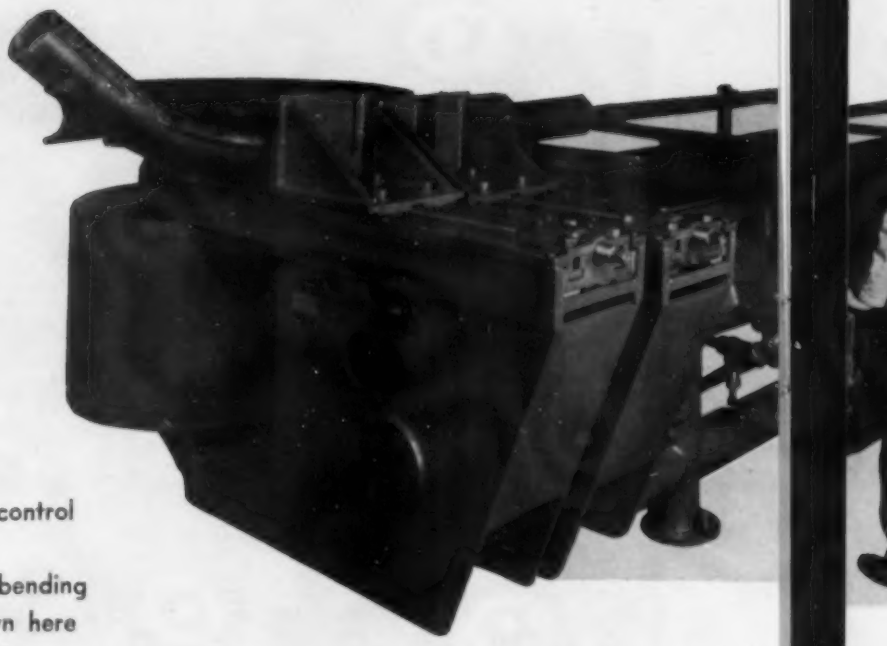
When pressure in the main ram has fallen to the setting of the DELAY RELEASE pressure switch set at 300 to 500 psi, the UP air valve is energized shifting the 4-way operating valve to direct flow from the left-hand pumps to the lower end of the auxiliary cylinders and shifting the SPEED CHANGE valve to by-pass the adjustable orifice which allows the 2-way prefill valves to open rapidly thereby exhausting the main ram freely.

As the platen moves up, the EJECT limit switch is tripped to actuate the EJECT UP and EJECT UP-DOWN valves. This shifts the 3-way PRESS-EJECT valve controlling the output from the right-hand pumps and

Concluded on page 123

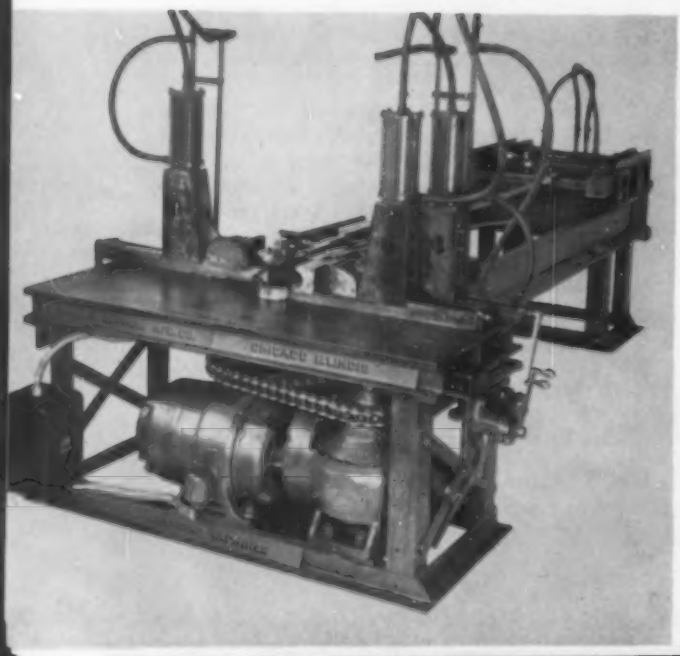
● By F. J. Lammers

Vice President, Wallace Supplies Mfg. Co., Chicago, Ill.



Hydraulics for both power and control has been the most important technological advance in rotary bending during the last generation. Shown here are applications by a major builder of bending equipment using circuit ideas developed over the last 20 years.

FLUID POWER FOR BENDING

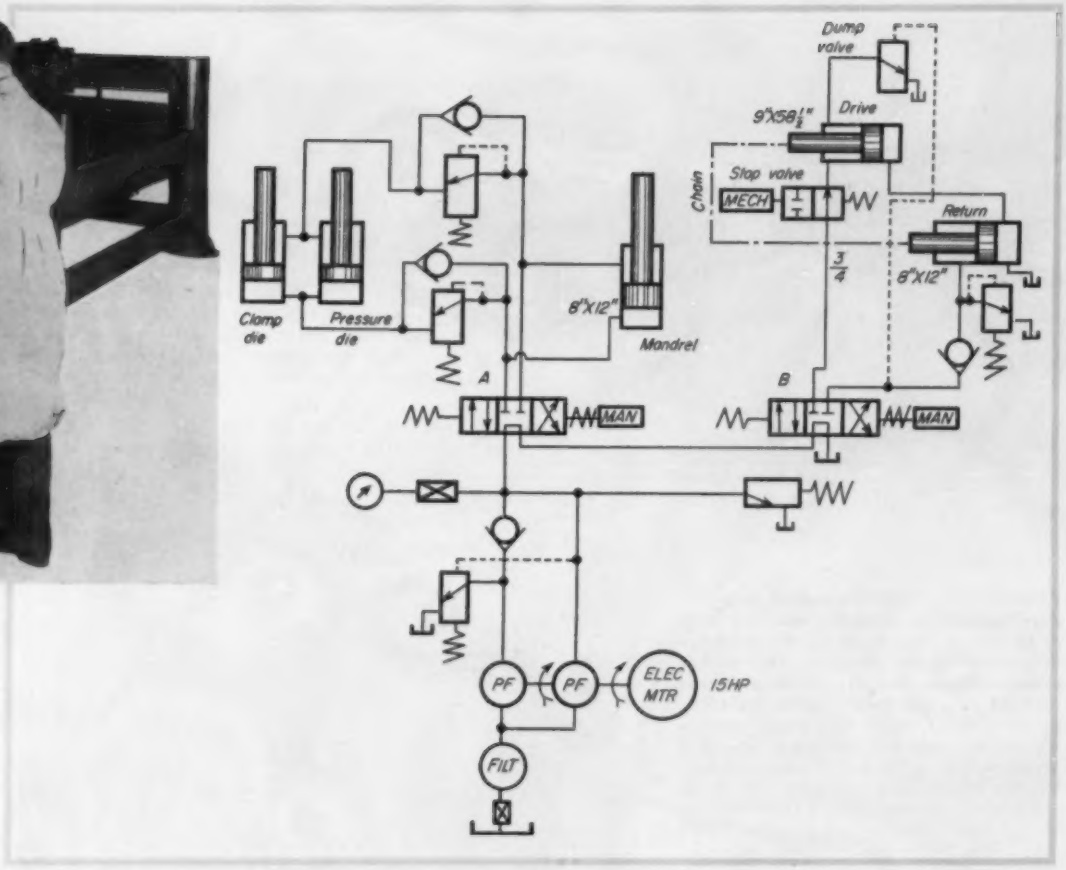


BEFORE hydraulics, bending machines were driven mechanically—usually by a gear train. The control of bending was limited by clutches or brake units, and uniform, continuous power was limited by the accuracy and smoothness of gear teeth. Maintenance was high, especially for the clutch and brake parts.

Starting about 1935 the application of hydraulics resulted in important advantages:

a. Hydraulic power is much more uniform, and eliminates variations from wear of gear teeth, keys, splines, and shaft bearings. On critical work this often means the difference between a good bend or a broken piece.

ON THIS EARLY DESIGN the workpiece was rotated by an electric motor driving through a chain and gear reducer. The required high output torques could be obtained, but speeds were fixed. Control of bending was controlled by clutches and brakes, and maintenance on these parts was high.



CIRCUIT FOR HEAVY BENDING machine which requires frequent changeover. Valve A is operated to extend the mandrel cylinder and then the clamp die and pressure die cylinders. Valve A is then released and valve B is operated to retract the drive cylinder and rotate the workpiece until the stop valve is closed. Operation of valve B in the opposite direction retracts the return cylinder to rotate the head in the opposite direction. Pressure on the rod end of the return cylinder opens the dump valve to provide a drain for the drive cylinder while the stop valve is closed.

b. Accuracy of forming has been greatly increased. Rotation of the work now accomplished by hydraulic cylinders is more constant and dependable.

c. Control and variation of machine function is better. Hydraulic control valves give the operator sensitive, flexible operation. The operator has ready control of starting, slowing or stopping every part of the forming cycle.

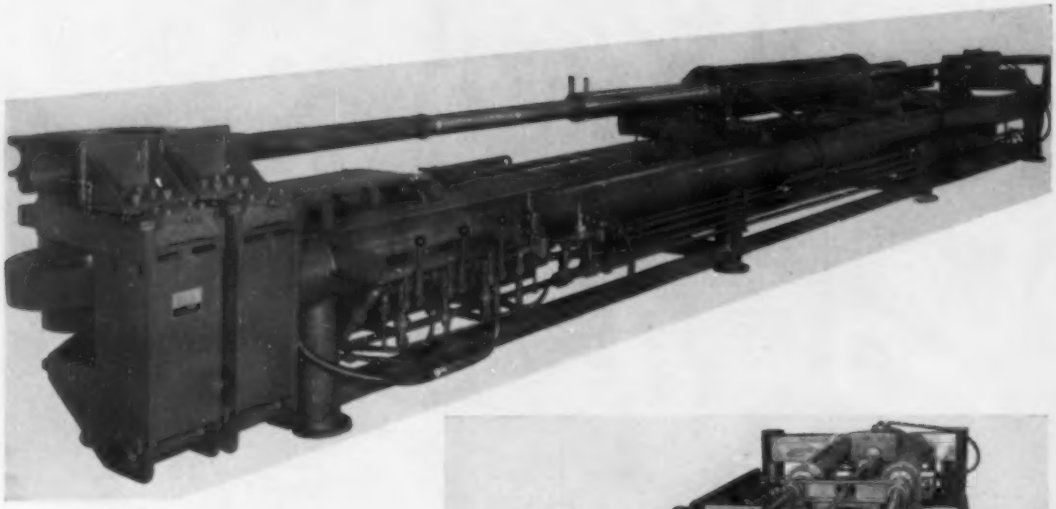
d. Maintenance has been greatly reduced and simplified with fewer parts and less wear. Adjustment and replacement of clutches, intermediate shafts, pinions, gears, worms, and transmissions has been eliminated.

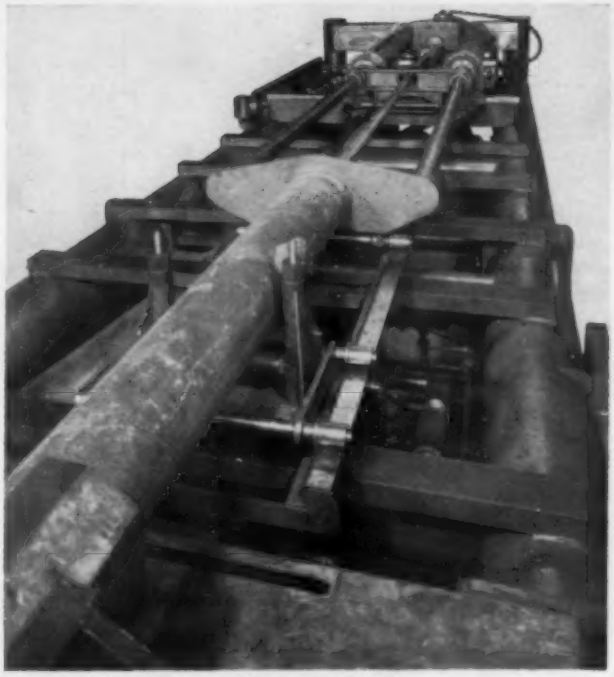
In bending furniture, automotive parts, or any high-production units, the operating cycle is apt to be: a. position and clamp the material, b. bend, c. release material to the next operation, d. return machine to starting position.

This is a good application for sequence valves to carry out a preset program. The simplest circuit for this operation first directs pump output to a clamping cylinder. Usually a companion cylinder operates in parallel to position an auxiliary pressure die which gives the forming pressure. The main drive then rotates the headshaft.

After both clamp and pressure dies have closed, a sequence valve opens and the drive cylinder is actuated for the desired degree of bend. It is stopped by a 2-way cam-operated valve which opens the line to the cylinder. Oil then spills over the main relief valve and returns to tank. The operator then reverses a hand valve to open the clamp and pressure dies and remove the work.

When bend radii are small, tubes or special sections will flatten and distort, and a shaped mandrel is used inside the section to maintain the cross section. Friction and forming stresses may tend to lock the section onto the mandrel at completion of the bend, and power mandrel release is desirable. Early designs had a manual screw or separate air cylinder for retraction of the mandrel rod. Now





PUSHER CYLINDERS are used on heavy-duty benders to simplify material handling and to reduce clamp die, pressure die, and mandrel friction. The pusher cylinder thrusts the pipe or other section forward at a controlled speed according to the rate of bend. The single concentric pusher cylinder above has a hollow piston rod to accommodate the mandrel. On the bender at right, the duplex pusher cylinders are mounted on each side of the mandrel unit.

this is usually done by a hydraulic cylinder.

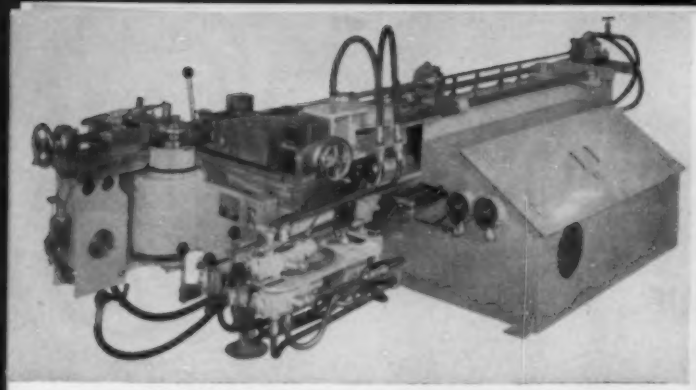
For job lot or general production bends, this mandrel cylinder is incorporated into a semi-automatic circuit with this program:

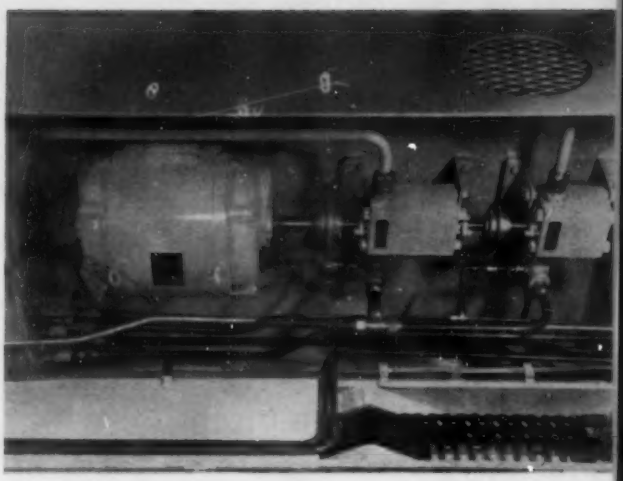
First the mandrel moves to bend position. The clamp and pressure dies then close on the material and the bending head rotates to the pre-selected angle. After the bend is completed, the mandrel retracts, the clamp and pressure dies open, and the bending head returns to start position.

Many jobs require maximum production, perhaps 600 bends per hour or more. The cycle can be shortened by using electrical controls such as limit switches and solenoid valves. This also permits a variety of production cycles to be selected from a centralized control panel.

Power plant, process, and marine piping bends present a very different problem. One or two large pieces of pipe may be the maximum required per tooling set-up, and flexible control is important. The program elements are best controlled individually by the operator—step by step. For such job-shop work, a divided sequence circuit is usually preferred in larger benders. Each action is separately controlled by the operator.

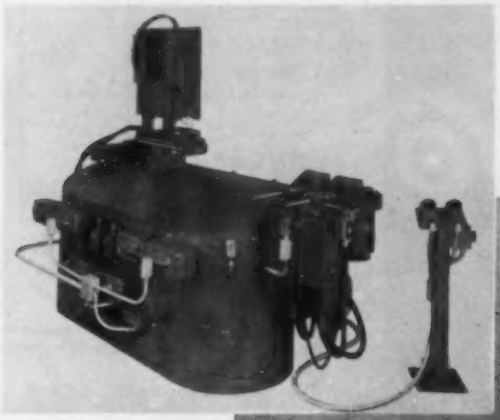
Many jobs may involve manipulating several tons of pipe or tube per part. Even with adequate cranes, exact positioning and indexing of such loads is tedious and expensive. Clamping pressures and friction of pressure dies and mandrels are also very large. In 1936 Wallace introduced hydraulic pusher units into the hydraulic circuit to reduce clamp load, pressure die and mandrel friction, and to simplify material handling.

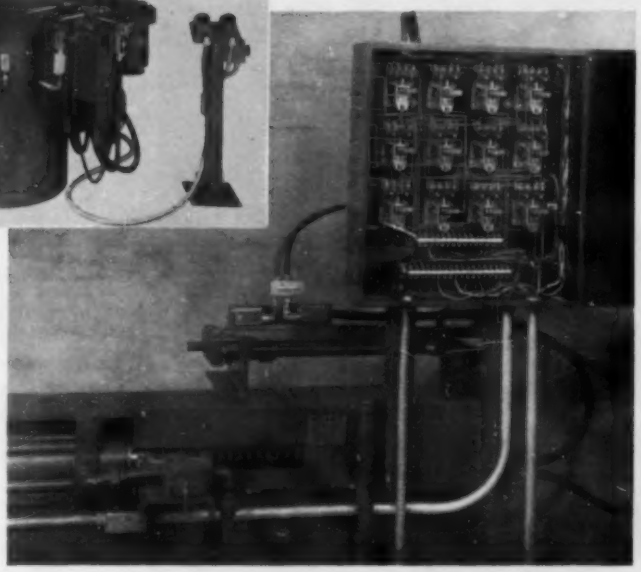




SPECIAL HYDRAULIC DESIGN is required for aircraft benders such as this. Cylinders must be extra large and should be actuated individually. They must be mounted for maximum rigidity because any significant deflection of the cylinder supports, frame, or tooling will deform the workpiece.

POWER UNIT for the aircraft bender uses two gear pumps driven in tandem. Pumps and electric motor are housed in a ventilated enclosure for protection.





HIGH PRODUCTION BENDING of 600 bends per hour or more requires electrical control shown on this unit. An electrical system also permits a variety of production cycles to be selected from the control panel. This unit has nine different programs.

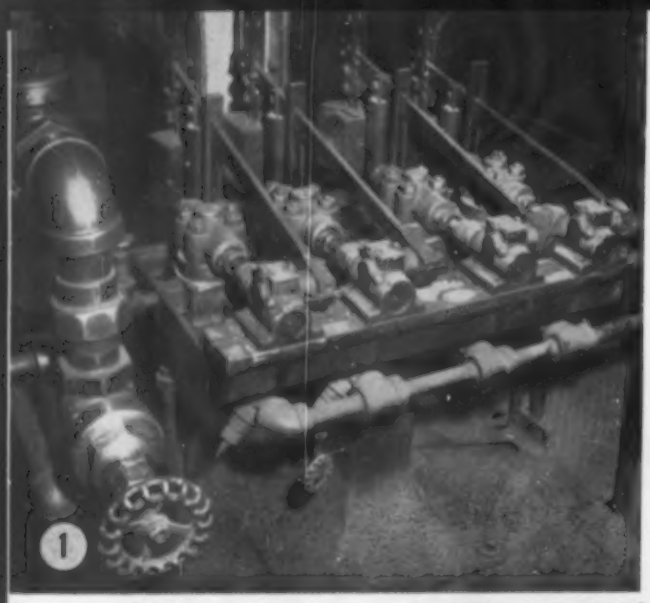
The pusher unit thrusts the pipe or other section forward toward the bending zone at a controlled speed comparable to the rate of bend. This varies greatly from job to job because of changes in bend radius and bending speeds. The pusher thrust must not be so great as to deform the straight tube, and yet it must reduce friction on the pressure die, clamp die and mandrel for critical bends.

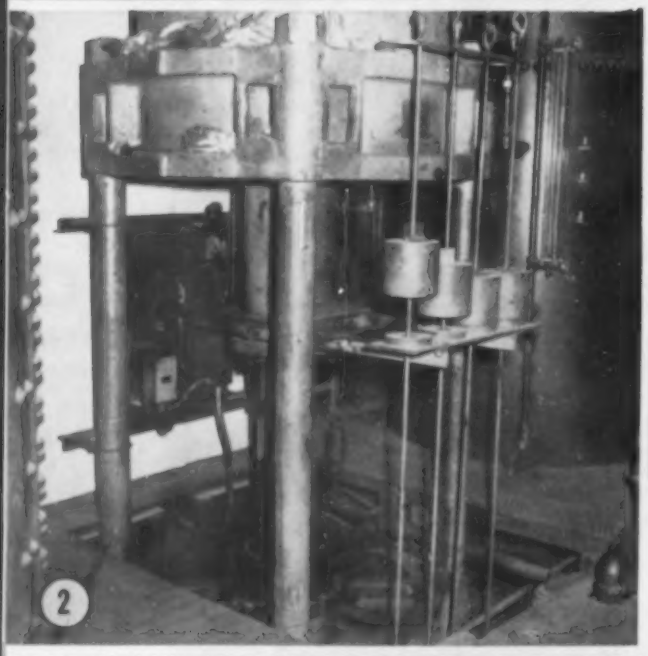
In addition to improving bend quality, such pusher cylinders aid indexing, and removal and transfer of heavy bend sections. This frees crane facilities and makes a more efficient, self-sufficient operating center.

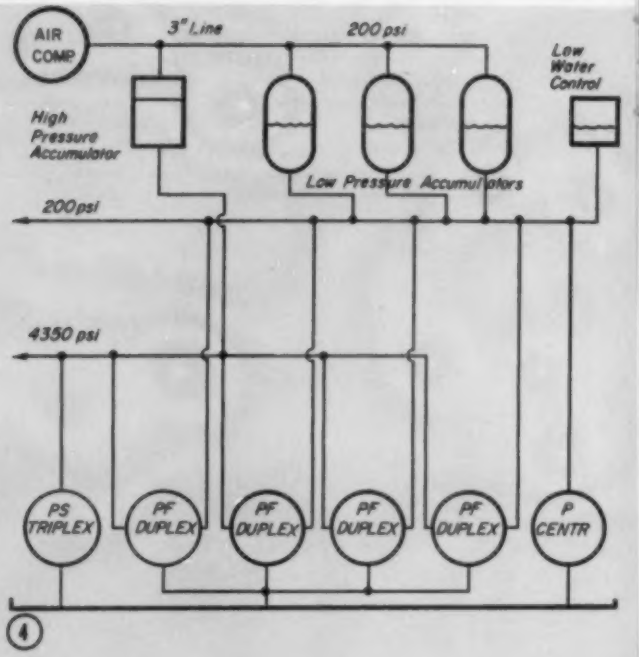
Hydraulic circuits for benders usually operate at 1000 psi or more. For job work on usual tubing and capacities to 4-inch, extra-heavy, mild, steel pipe, a single pump is usually used with two 4-way manual or solenoid-operated spool valves. These are generally open-center design, so that oil flows con-

Continued on page 122

BOOSTING CENTRAL







1 **VALVES CONTROLLING DUPLEX PUMPS** are actuated by cables running to the high pressure accumulator. Weights at rear of actuating arms counterbalance the weights at the accumulator. As accumulator piston rises, valves are actuated to bypass delivery to tank.

2 **HIGH PRESSURE ACCUMULATOR** actuates weighted cables controlling valves which connect delivery of duplex pumps into system according to accumulator water level. Mounted on the wall at the rear of the accumulator are the limit switches which sense position of the accumulator.

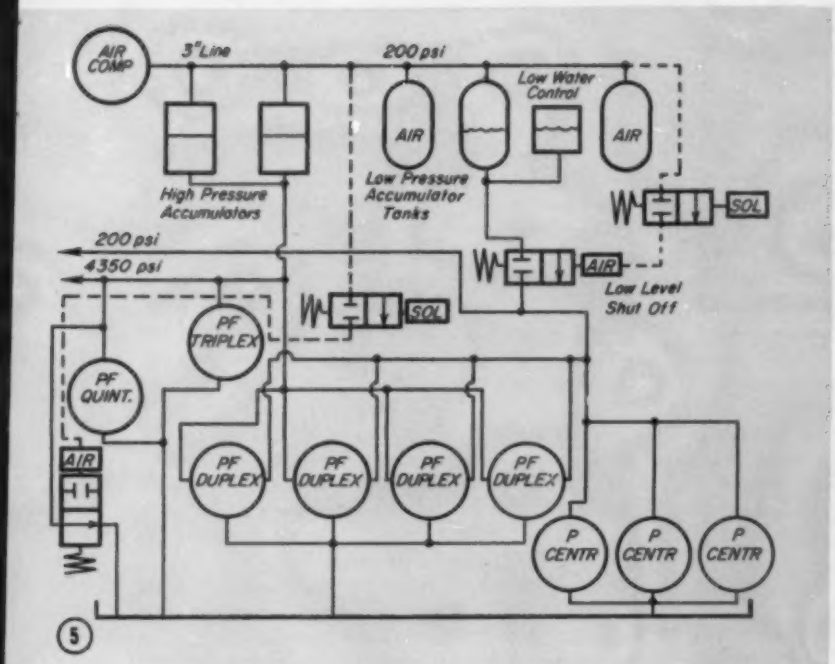
3 **COMBINATION RELIEF AND UNLOADING VALVE** controls 35-gpm output of quintuplex pump. Normally open diaphragm-operated valve is controlled by a normally closed solenoid-operated valve.

4 **ORIGINAL SYSTEM** supplied 4350-psi fluid from four duplex pumps and a triplex pump. 200-psi system was supplied by duplex pumps and centrifugal pumps. High pressure output of duplex pumps was controlled by valves mechanically actuated by accumulator level.

5 **MODIFIED SYSTEM** has new quintuplex pump as main source of high pressure fluid. Only one low-pressure accumulator tank now contains water for greater stability of air pressure and high pressure. Two-way, air-operated valve has been connected in line to low pressure accumulator to prevent air from entering lines.

SYSTEM CAPACITY

• By Nicholas P. Wakeen



Central systems must be flexible for future expansion. Constantly increasing production and the addition of new presses made this one insufficient to maintain pressure at peak loads. Three new pumps and an accumulator were added to increase capacity and permit maintenance without shutdown.

ONE of the most important steps in manufacturing grinding wheels is pressing the abrasive mix in a mold under hundreds of tons of force, and the quality of the finished product depends on the accurate control of pressure in the press.

After several years of progressive expansion in one of its pressing departments, Norton Co. found it necessary to make a survey of the central hydraulic system which supplied the presses. Downtime during maintenance, and the danger of production slowdown due to excessive demand made this survey very desirable. The water system which had been in operation for over 20 years consisted of a 200-psi section to open and close the presses, and a 4350-psi section for compressing the grinding wheel mix in the molds. The hydraulic equipment at the time of the survey included the following main compoents:

a. Four horizontal duplex, reciprocating plunger pumps supplying both high and low pressures.
b. One centrifugal pump to maintain water level in the low pressure accumulators.
c. One triplex pump operating intermittently to supply high pressure.
d. One high pressure, piston type accumulator.
e. Three low pressure tanks acting as accumulators.
f. One air compressor.

NICHOLAS P. WAKEEN, *Plant Layout Engineer, Plants Engineering Dept., Norton Co., Worcester, Mass.*

The survey showed several shortcomings in the system. System capacity was insufficient to meet maximum peak demands of the presses. This caused large movements in the high pressure accumulator piston, with reduction in pressure when the piston was near the bottom of its stroke. If the piston bottomed completely, high pressure was lost causing a shutdown of production until the pressure could be restored.

A loss of even one duplex pump for repairs could mean a slowdown in production, and any maintenance on the high pressure accumulator meant a complete shutdown.

Variations in requirements on the low pressure system affected the water level and air pressure in the low pressure accumulators. These variations in air pressure affected the high pressure. A complete loss of water from the low pressure accumulators allowed air into pipe lines. This was not only dangerous to the operators, but required a shutdown

of at least four hours to clear the system of air and restore the proper air-to-water ratio at the operating pressure in the accumulators. The planned addition of more presses would place still more of a burden on the system.

REQUIREMENTS OF NEW SYSTEM

To determine the necessary requirements for the system, actual measurements were taken at each press, and this data was used to find the total volumetric displacement of the equipment. It was found that maximum possible demands of fluid were 95 times the average high pressure demand and 26 times the average low pressure demand.

The answer to this was, of course, that the presses required maximum capacity only during a small portion of the molding cycle and most of this demand was supplied by the accumulators. The time of high pressure is only a matter of a few seconds. The low pressure cycle is somewhat longer because of the time required to open and close the presses.

Determining the proper ratio of pump capacity to maximum possible demand is largely a matter of experience. In this system, the high pressure accumulator was satisfying an instantaneous demand of little more than three times the maximum pump capacity. While this ratio had been adequate, it was decided to double it to provide ample capacity for expansion in the future.

System capacity has been increased by adding a high pressure, high speed quintuplex pump, two low pressure centrifugal pumps, and one high pressure accumulator. The old system using the duplex pumps remains essentially the same, except for changes necessary for the installation of the additional equipment, and it is now being used as an auxiliary system. The new equipment is used as the main hydraulic system, and the two can be operated together if necessary.

The new high pressure accumulator was installed so that the accumulators can operate individually or together as required. The 35-gpm quintuplex pump runs continuously and bypasses its output to the reservoir when the accumulators are at capacity. The three air-water accumulator tanks are now arranged so that water is used in only one of the tanks, and the other two have air only.

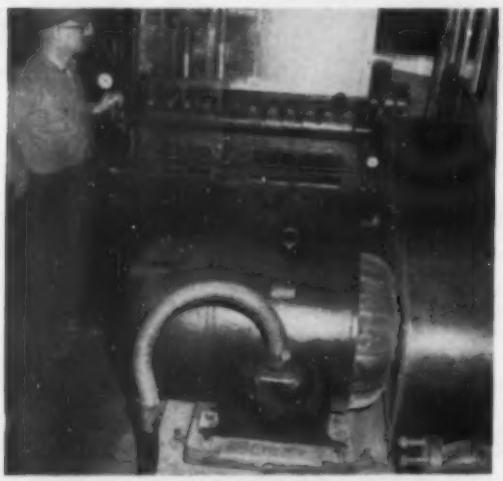
The highest water level in the air-water tank has been determined, and three water level control switches have been installed. One switch is mounted at the high water level and the other two at lower positions. These switches control the operation of the three, low pressure centrifugal pumps. All of the pumps or any combination can be controlled by the switches while the remaining pumps operate continuously.

When the demand is such that the continuously operated pump cannot maintain accumulator water level, a second pump cuts in automatically to supply additional capacity. This permits continuous operation without changes in pressure or capacity and insures continued production when making repairs to any of the three pumps.

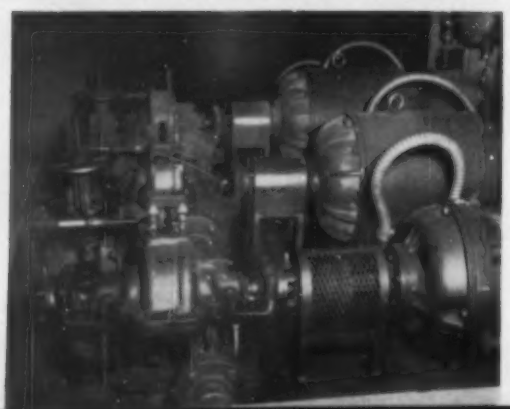
A low water level switch has been installed on the air-water, low pressure accumulator tank to prevent air from getting into the hydraulic lines. This energizes a solenoid-controlled, diaphragm-operated valve to prevent loss of water and air pressure in case of a break in the supply lines to the presses or a loss of electrical power to the system.

Normally, one low pressure pump operates continuously with its delivery increasing with a decrease in water pressure. This tends to maintain a constant low pressure water supply to the presses and keep constant air pressure above the high pressure accumulators.

The improved system has been in operation for over two years. With increased production requirements, there has been no trouble with inadequate pressure. ▼▼▼



NEW QUINTUPLEX PUMP is driven at 865 rpm by a 100-hp motor through a V-belt drive. John Wicke, standing by the pump, is maintenance man for the central system equipment which also includes a 7.3-gpm triplex pump and four duplex pumps each delivering 5.6 gpm at 4350 psi and 38 gpm at 200 psi.



TWO ADDITIONAL CENTRIFUGAL PUMPS have been installed to supply requirements of the low pressure system. The 2-stage volute pumps deliver 100 gpm each against a pressure of 187 psi and have a shut-off pressure of 202 psi.

Fig. 1. Three of the five reciprocating triplex pumps used to power two extrusion presses are shown here in the pit where they are located. One of the two centrifugal supercharge pumps used in this application is at the extreme left of the photo.

EXTRUSION PRESS DESIGN

. . . uses reciprocating plunger pumps

• By Joseph R. Dyer

Project Engineer, Superior Industries, Inc.
Youngstown, Ohio

LOW fluid cost and minimum maintenance are desirable in any hydraulic application. Fire resistance is almost a necessity in applications where a hot material is being processed. Here's how all these desirable results have been achieved on an aluminum extrusion press setup at Superior Industries in Youngstown, Ohio.

Five triplex-type reciprocating pumps and eight accumulators make up the centralized hydraulic power supply for operation of two aluminum-extrusion presses. Fluid used is water and 10% soluble oil. This fluid is used because it is inexpensive and constitutes no fire hazard

should it come in contact with the heated aluminum billets. Another advantage of using the water and soluble oil mixture in this application is that air rather than nitrogen may be used to charge the accumulators.

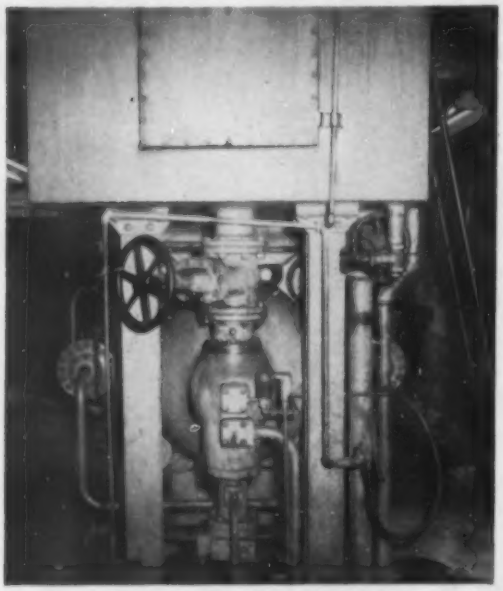


Fig. 2. End view of the larger extrusion press shows the reservoir mounted on top of the press for gravity prefill of the main ram.

Fig. 3. Hydraulic circuit of the centralized hydraulic system used to operate two extrusion presses.

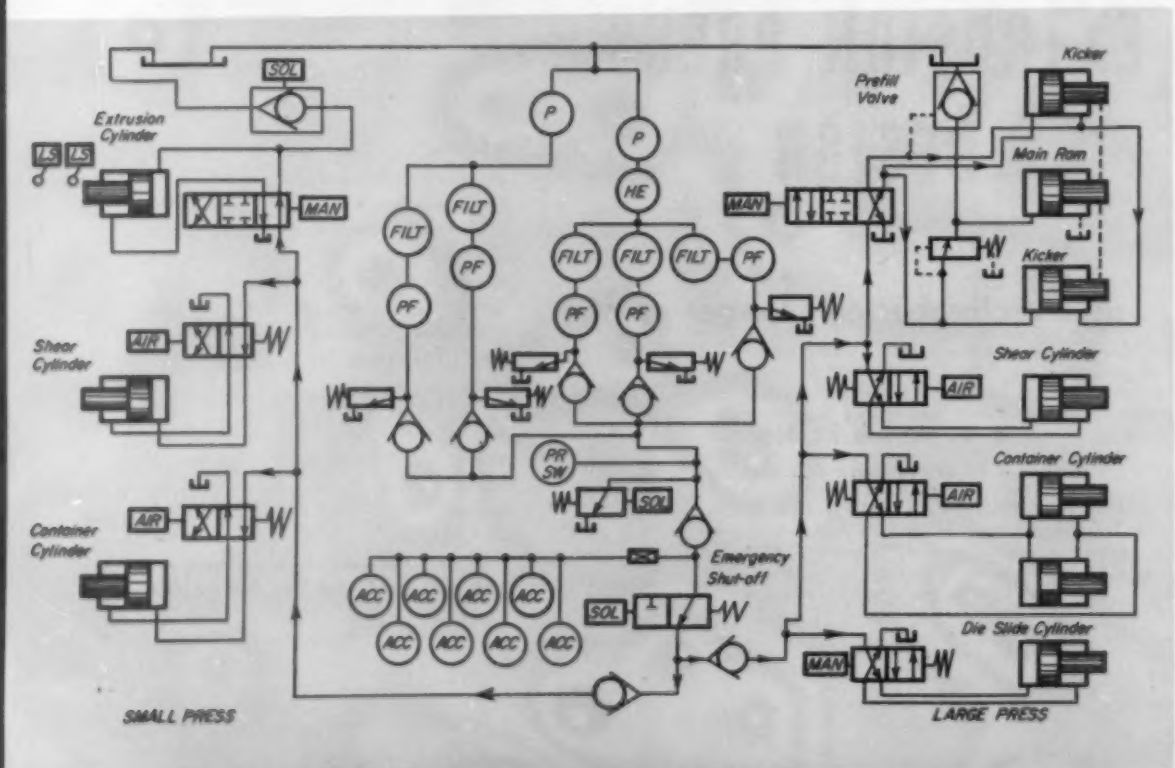
Pumps are mounted in a pit, Figure 1, at one end of the building in which the presses are installed. The triplex-type reciprocating pumps were selected for this application because of their ability to handle the oil-water mixture with high efficiency and a very satisfactory wear rate. Electrical and hydraulic circuitry permits either two or three of the pumps to operate when only one of the two presses is in operation. Since the main fluid reservoirs are mounted atop the presses, Figure 2, at quite a distance from the pumps, two centrifugal pumps are used to supercharge the main pumps.

• **Circuit**—Output of the pumps is fed to the press circuits or the accumulators depending upon system requirements, Figure 3. A pressure switch and solenoid-operated unloading valve are used to unload the pumps when the accumulators are fully charged. A manual shutoff valve is used in the line connecting the accumulators and the pressure line. There is also a solenoid-operated emergency shutoff valve in the pressure line.

Circuit of the larger of the two presses includes shear and container cylinders which are controlled by air-operated, two-position, four-way valves. Die slide cylinder of the large press is controlled by a manually-operated, two-position, four-way valve. Press platen is rapidly advanced until it contacts the billet and retracted by two small kicker cylinders. Platen advance and return are controlled by a manually-operated, three-position, four-way valve.

As the platen of the large press is advanced by the kicker cylinders, pressure is blocked from the main ram by a sequence valve and the main ram is filled by gravity from the reservoir atop the press through the prefill valve. When the platen

Concluded on page 100



COMMERCIAL'S CONTROL VALVE HELPS MOVE DIRT FASTER...EASIER

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The hydraulic cylinders on the new crawler-mounted earth mover actuate the boom, swing, lift, crowd and bucket. The Commercial fluid power valves make 'em jump through a hoop right on cue because their throttling characteristics are extremely sensitive.

LOAD DROP ELIMINATED. A positive-hold check built into every operating manifold section of the valve eliminates load drop—regardless of the number of sections which may be in operating position. Return flow is blocked until the return pressure is overcome by pressure build up from the pump.

PARALLEL CIRCUIT BUILT IN. Another characteristic of the valve, a built-in parallel circuit, permits two or more cylinders to go through their paces simultaneously. This makes digging and unloading virtually one smooth, continuous operation. Faster backhoe action like this—so vital to schedule-conscious contractors—is further reflected in the valve's inherent reduced back pressure.

REDUCED PRESSURE DROP. Numerous design features in the Commercial valve have just about relegated the bugaboo of internal pressure loss to a back seat—as much as 25% back, in fact. Larger passage-ways of more uniform cross section, free from abrupt change of direction, and with smoother walls, plus solid spools without internal restriction, all give internal flow a big boost—put more fluid power to work. And with O-rings—instead of gaskets—for sealing between sections and at ends of spools, this fluid power stays right on the job at working pressures up to 2000 psi. With the kind of exact and precise timing action provided by the Commercial power control, "inching" loads to exact position becomes routine.

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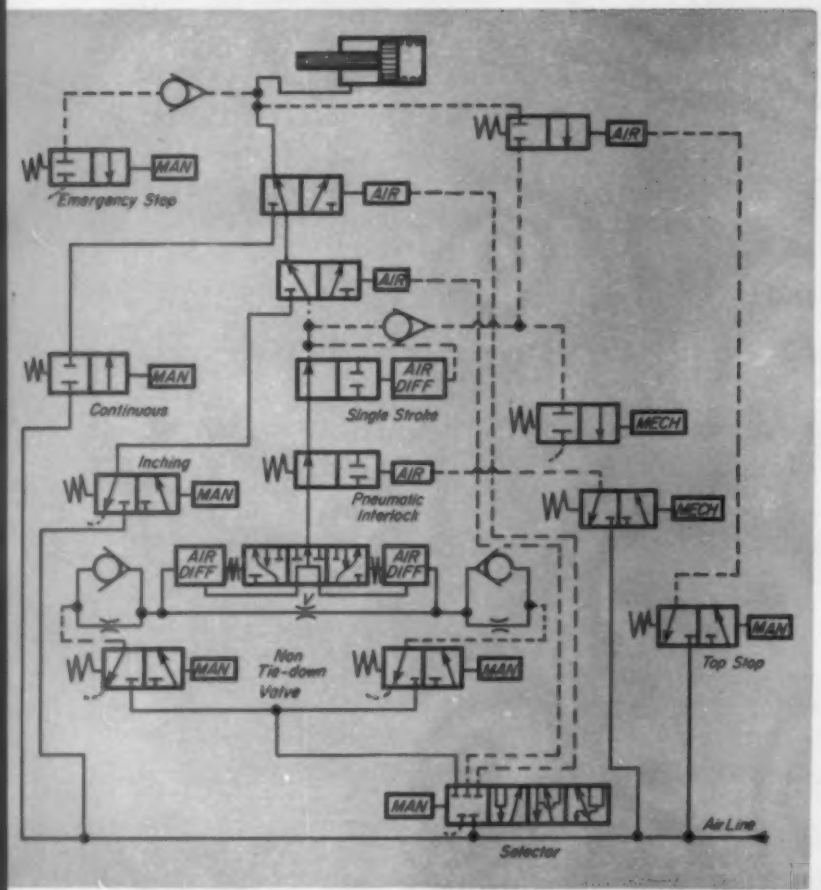
Need for controls to protect operators of presses, brakes and similar machines is widely recognized. There are advantages to the designer as well as the machine user to have controls which are all the same type.

AN ALL-AIR PRESS SAFETY CIRCUIT

...allows flexible cycles and setups



Circuit and valve data courtesy Ross Operating Valve Co.

FIG. 1. RECENTLY INTRODUCED PALM-BUTTON, non-tiedown and single-stroke valves make this all-air controlled press safety circuit possible. Although designed primarily for use on presses and brakes, the valves and circuit may also be used on other similar machines.

MACHINES requiring that both of the operator's hands be on control buttons to insure his safety may now use an all-pneumatic control system. This has been made possible by the recent introduction of a non-tiedown valve, a single-stroke valve and a palm-button valve.

• **Safety Circuit**—A suggested circuit incorporating the new valve has also been developed. Designed primarily for use on presses and brakes, the valves and circuit may also be used on similar machines.

In the control circuit, Figure 1, two of the palm button valves are connected between the air supply and the non-tiedown valve. Air flow from the non-tiedown valve is to a pneumatic interlock valve which is actuated by a mechanically-operated pilot valve. The interlock valve makes it unnecessary for the operator to hold the palm-button valves depressed during the entire operating cycle. Air is fed from the interlock valve to the single-stroke valve and then to the clutch-brake actuating cylinder to initiate the press cycle.

The basic circuit can be modified to provide additional functions such as inching, emergency stop, continuous operation and top stop by adding components. Inching control allows the press to be stopped at any point for setup and restarted. The continuous opera-

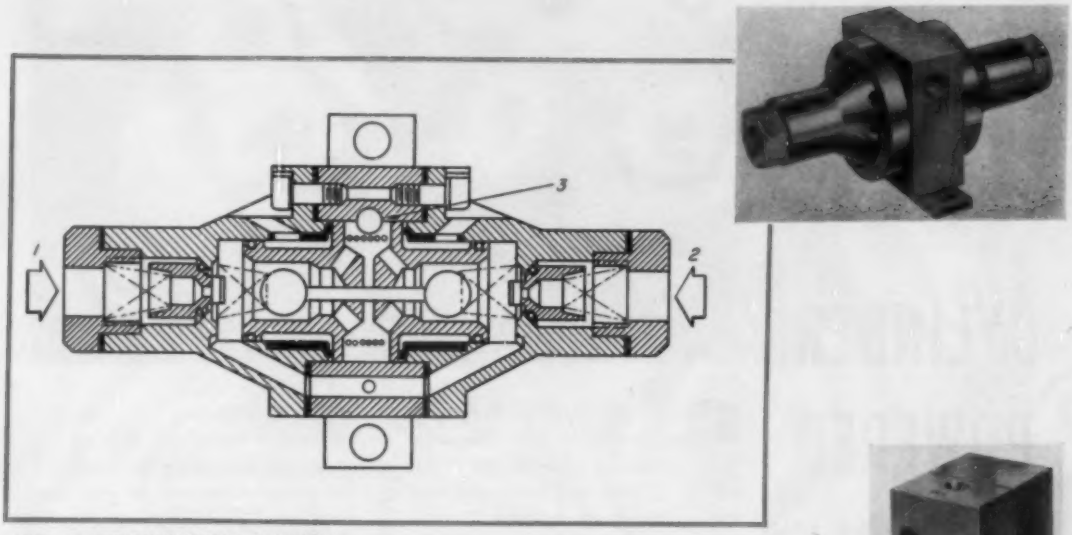


FIG. 2. NON-TIEDOWN VALVE is designed so that inlet air from both palm-button valves must be supplied almost simultaneously to initiate press operation. Any attempt to tie down one of the palm buttons results in air being exhausted at the non-tiedown valve.

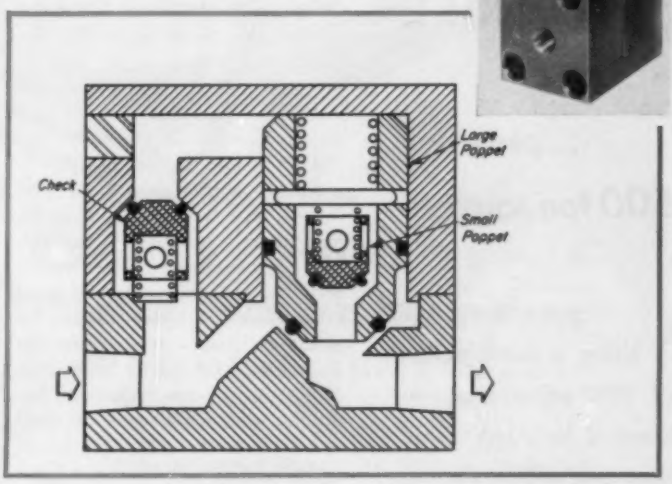


FIG. 3. SINGLE-STROKE VALVE makes repeating of the press cycle impossible even though both palm buttons are held down. Pressure must be removed from the inlet port in order for the valve to pass air for the succeeding cycle.

tion circuit permits automatic cycling and continuous feed. Top stop control is used to stop the press at top dead center after a period of continuous operation. A selector valve is used to select the required function.

• **Non-Tiedown Valve**—Air flow through the non-tiedown valve during normal operation is illustrated in Figure 2. Air enters through ports 1 and 2, passes through orifice, and passages to the working system via port 3.

Symmetrical design of this valve makes it necessary that the operator energize and release both palm-button valves supplying input air to the valve for each cycle. A sensitivity control may be adjusted to require simultaneous operation of the palm button or to permit a degree of time lag between operation of the two buttons.

If the machine operator should attempt to tie down one of the palm buttons, air will be exhausted from the non-tiedown valve instead of energizing the circuit. Tying down either palm button creates an unbalance in the valve.

• **Single-Stroke Valve**—Continuous operation of the press, even though the operator holds the palm buttons down, is prevented by the single-stroke valve, Figure 3. Air inlet port 1 is connected to the non-tiedown valve. Incoming air unseats the large poppet to allow air to enter the working system through outlet port 2.

As pressure builds up in the working system, the small internal poppet opens allowing pressure to build up in the cavity above and around it. Pressure in the cavity permits the springs to move

Concluded on page 86

CYLINDER POWERED TOGGLE

...provides 500 ton squeeze

Using a combination of 1800 psi oil and mechanical leverage, more than one million pounds can be exerted by this compact, portable swaging press.

● By Les Ehman

Development & Research Engineer, Electric Steel Foundry Co., Portland, Oregon

DURING recent years, wire rope manufacturers have supplied their customers with the eye formed by slipping a sleeve over one end of the rope, bending the end around and inserting it into the sleeve, and cold-forming this sleeve around the rope. Since the eye must be as strong as the rope itself, the sleeve must be formed into a homogeneous mass around the rope under die pressure from 75,000 to one million psi.

This operation has been performed on a relatively small press, built along conventional lines with four upright posts guiding the ram and die, and anchoring the fixed cross-head. This is not efficient for swaging of wire rope, since the die area is not easily accessible. This type of press requires a hydraulic system pressure of 6000 to 10,000 psi to obtain the necessary die pressure with its one large cylinder or ram. Electric Steel Foundry felt that if a press could be designed using much lower hydraulic pressures, maintenance and repair cost would be drastically reduced and portability and compactness would be so greatly increased that the press would find wide acceptance.

● **Combined forces**—The advantages of the ESCO press* were achieved by the combination of 1800 psi pressure and mechanical leverage. Two cylinders exert their force on a toggle joint. One end of the toggle is secured to the rocker. In effect, the rocker is a 35-inch lever. Since the dies are located twelve inches from the pivot of the rocker, this produces an increase of pressure at a ratio of almost three to one. The total combination of forces will produce jaw pressures far above the one million pounds required for wire rope swaging. These pressures exceed the design strength of the press itself, so mechanical stops are provided to limit the included angle of the toggle to 14 degrees.

● **Die travel**—The dies have a travel of three inches and the cylinders have a stroke of seven inches. Speed of travel of the upper die is quite rapid, but slows down in proportion to its distance from the lower die. This slow motion near the end of the stroke allows the operator to see exactly what the sleeve and dies are doing. By using two 6 inch cylinders, over-all opening and closing time has been reduced to seconds. The dies close in approximately ten seconds and open in six.

● **Hydraulic system**—The hydraulic system utilizes a standard PVT unit, (pump-valve-tank unit used by a large lift truck manufacturer), and two six-inch cylinders. This extremely compact unit is simply bolted to the side of the press, along with a 7-1/2 hp, 1150 rpm, 220-440 volt motor.

The aluminum oil reservoir contains an 8 gpm pump, a two-plunger valve, and five gallons of oil. Only one spool of the valve is used, and the relief valve is set for a maximum of 1800 psi. On the down stroke both cylinders apply pressure to the toggle, while on the upstroke, only one cylinder is piped in, giving a quick return of the dies. ▼▼▼

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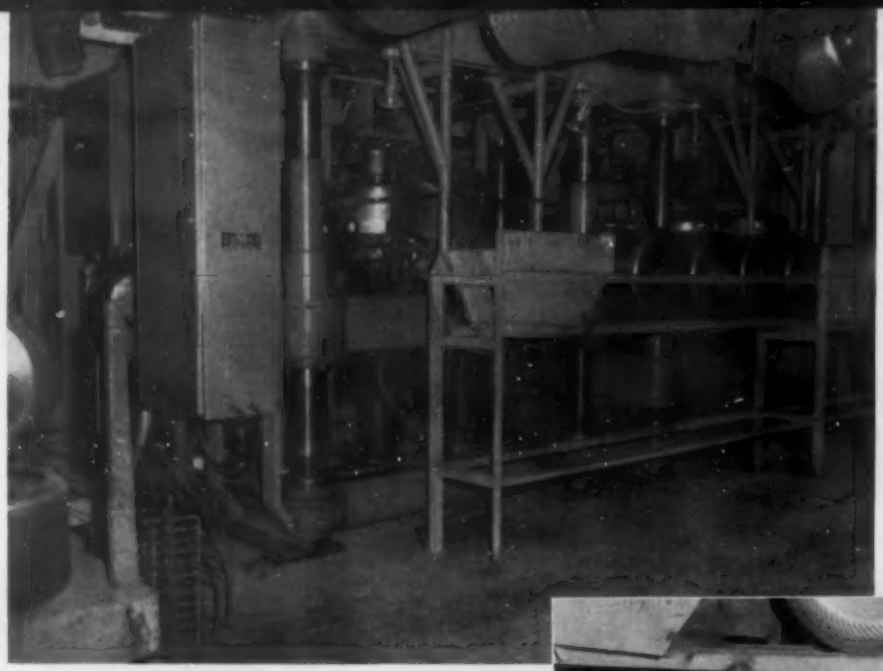
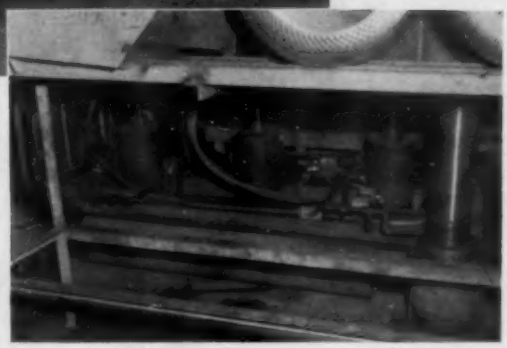


AIR CYLINDERS raise weld head and automatic washing machine baskets into position for welding center post on this machine.



THREE 8-INCH CYLINDERS raise platen. Two outside cylinders are constantly under pressure from two storage tanks and serve to counterbalance the platen. Cylinders have a stroke of 18 inches.

PROVIDING A POSITIVE STOP . . .

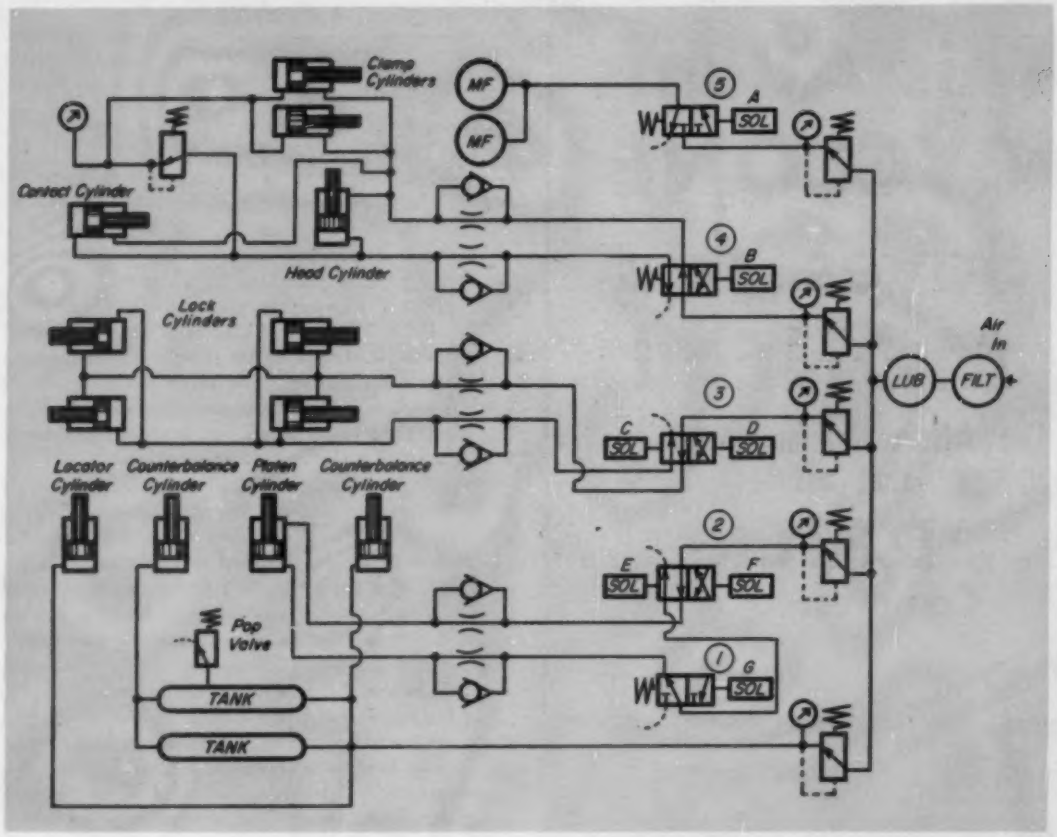
Raising the work platform to an accurate level and holding against the welding force were two of the requirements on this welder. Air cylinders raise the work and provide a positive stop.

• By J. C. Kittle

THE forces required in a machine developed by Whirlpool to raise automatic washing machine baskets for welding the center post were not large, and it was determined that three 8-in. air cylinders could do the job. However, the position of the basket for welding was critical. It was necessary for the basket to come to a positive stop ready for welding near the top of the stroke. The force required to raise the basket was not sufficient to hold against the welding force, so some method of mechanically locking the basket in place had to be developed.

All of these features had to be incorporated into a high production machine which could process the baskets directly from a conveyor. Because the weld

J. C. KITTLE, *Welding Engineer, Whirlpool Corp., Clyde, Ohio*



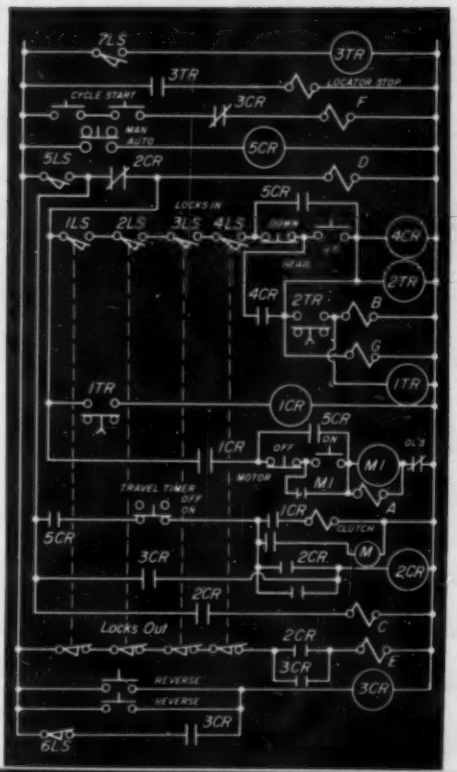
PNEUMATIC CIRCUIT shows connections to cylinders and five solenoid-operated control valves. Air pressures for the air motors, welding head cylinder, lock cylinders, and platen and counterbore cylinders are regulated by individual air-line controls with one filter and lubricator serving the system.

for a welder table

was circular around the flange of the center post, a means of aiding rotation of the basket during welding was necessary.

PNEUMATIC DESIGN

To minimize piping and valve sizes for the three raising cylinders, two of the cylinders are connected at all times to two 3-cu. ft. storage tanks under pressure. The force exerted by these two cylinders is not sufficient to raise the platen and basket, but with the additional force of the platen cylinder, the platen is raised. Consequently air flow



SEQUENCE OF THE WELDER is controlled by synchronous motor timers and limit switches. Limit switches 1-LS, 2-LS, 3-LS, and 4-LS are double pole double throw units actuated by the locking cylinders.

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PROVIDING A POSITIVE STOP

Concluded from page 85

through valves 1 and 2 in the air circuit is only that required by the platen cylinder.

When the platen is completely raised, the lock cylinders are extended. Solenoid *G* of valve 1 is then energized exhausting the head end of the platen cylinder and allowing the platen to lower to the position permitted by the locks.

When the locks are extended, limit switches 1-LS, 2-LS, 3-LS, and 4-LS are actuated to energize timer 2-TR. This actuates timer 1-TR and solenoid *B* when it times out. The welding head extends to the work and electrical contact is made for welding. When timer 1-TR times out, it actuates solenoid *A* to start the air motors rotating the basket, start weld current, and start the weld head drive motor.

The rotation of the basket is controlled by the travel timer. When this times out, solenoids *A*, *B*, *D*, and *G* are de-energized and solenoid *C* is energized. The basket stops rotating, welding current is cut off, and the welding head retracts. The lock cylinders attempt to retract, and because solenoid *G* has been de-energized, the two counterbalance cylinders and the platen cylinder raise the platen insuring release of the locks.

At the end of the retract stroke the lock cylinders actuate limit switches 1-LS, 2-LS, 3-LS, and 4-LS, momentarily energizing solenoid *E* to lower the platen. Limit switch 7-LS is actuated when a basket is positioned in the fixture and actuates a solenoid-operated locator stop.

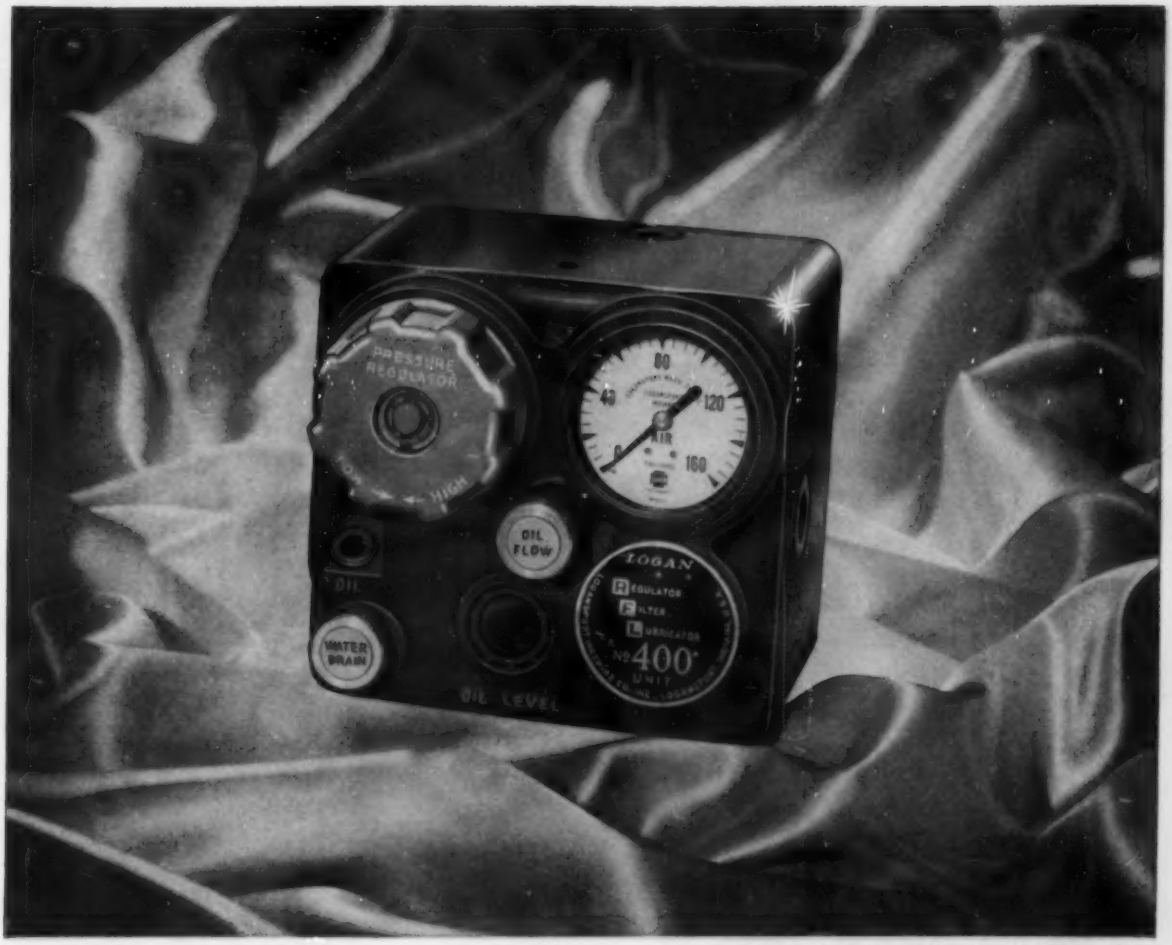
Speed control valves with integral check valves for free reverse flow are installed in the lines to the platen cylinder, lock cylinders, and welding head cylinder. These permit synchronizing cylinder movement with timer operation for proper cycling of the machine. A relief valve installed with the air tanks prevents excessive pressure build-up when the platen is lowered. ▼▼▼

AN ALL-AIR PRESS SAFETY CIRCUIT

Concluded from page 81

both poppets downward and close them. The poppets remain closed as long as inlet air is supplied through port 1. This isolates the inlet from the outlet and permits a small cam-operated valve connected between the single stroke valve and the clutch-brake cylinder to exhaust the air on the outlet side of the valve and apply the brake when the working stroke is completed.

When pressure is removed from the inlet side of the single-stroke valve by releasing the palm buttons, air under pressure above the poppets exhausts through the check poppet back through the palm-button valves. This permits the large and small poppets to move upward again so that the cycle may be repeated. ▼▼▼



Illustrated—Logan Model 400 RFL Unit

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New Model 400, illustrated above, is a companion model to the well-known Model 600.

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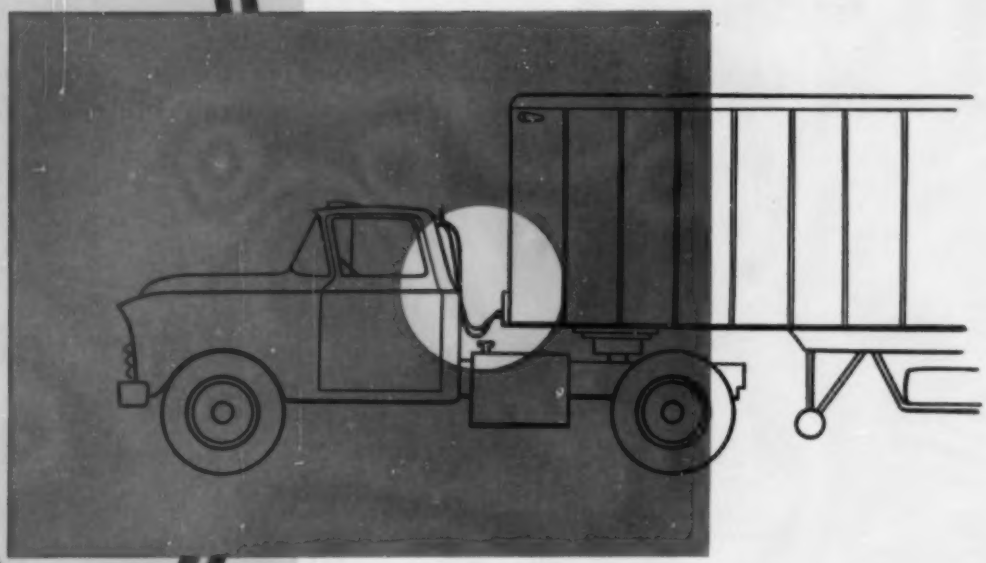

Big "rigs" of the open road have to have air-brake systems that stand guard at all times. There's no room for leakage or sudden failure. To transmit this braking power from cab controls to rear wheels, yet enable easy separation of tractor and trailer, requires flexible hoses with quick disconnects. These coupling devices must have a positive seal, withstand braking pressure and mechanical abuse, yet connect or disconnect with ease.

LINEAR'S ability to produce precision "O" rings—fast and economically—has provided safe, positive seals for airhose couplings . . . to keep the air in air brake systems. The exclusive Roto-Mold process assures physically better seals . . . dimensionally stable . . . free from foreign inclusions and flash.

No matter what your sealing problem may be—call on LINEAR or one of its agents for engineering assistance . . . and be sure to specify LINEAR Roto-Mold "O" Rings.

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Circle 82 on Reader Service Card

If you need 1000 psi to close molding dies, how do you prevent this pressure from being applied if something is caught in the die? Ordinarily the hydraulic system "gives everything its got", if the load calls for it. Here's an application of a standard pump control to protect against this.

PUMP COMPENSATION AT TWO PRESSURES

. . . protects molding dies

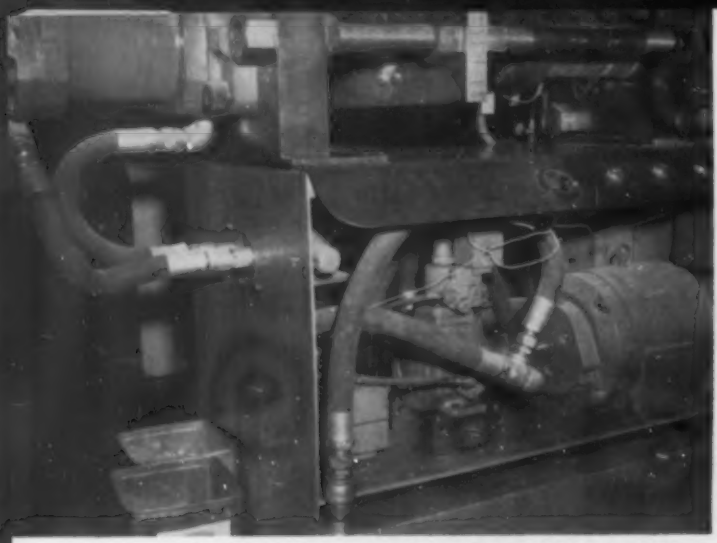
• By A. W. Jacobs

USING system pressure, in addition to a spring, to compensate a variable volume pump, gives two pressures at which the displacement is forced to near zero. The higher pressure controlled by the application of system pressure to the pump control can be applied only when it can do no damage if the machine is not ready for this high force. After some bitter experience in seeing dies smashed by a high force closing cylinder, Berea Plastics Co. designed a Nylon molding machine using the dual pressure compensation.

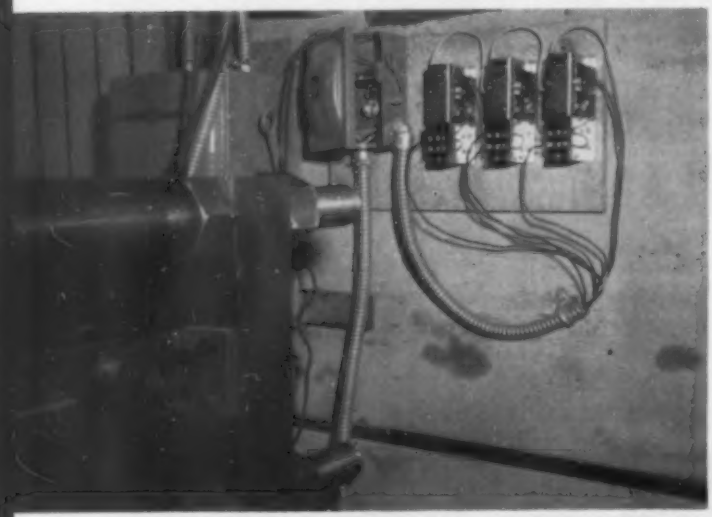
A 30-gpm vane type, pressure-compensated pump supplies the injection cylinder and the die-closing

A. W. JACOBS, *President, Berea Plastics Co., Berea, Ohio*

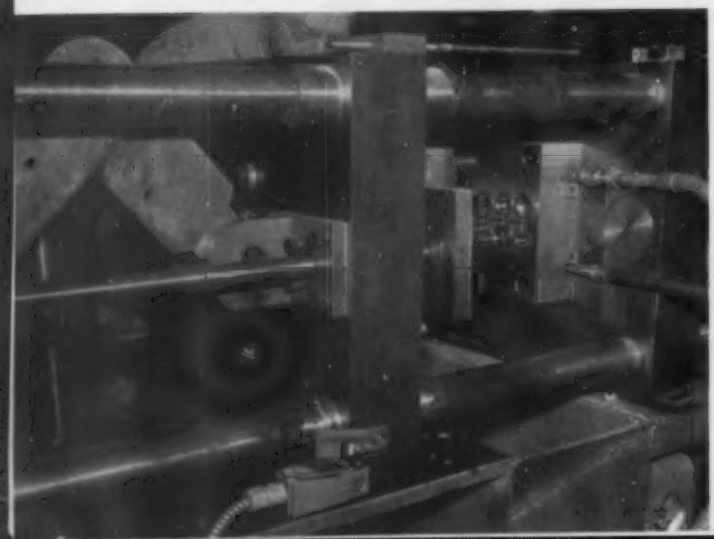
NYLON MOLDING MACHINE has been developed to produce bushings and bearings. Nylon pellets are loaded into hopper and pushed through heated section into locked dies by injection cylinder at left. Finished parts are stripped from dies by hand while pump is operating at low pressure setting with near-zero delivery.



SOLENOID-OPERATED PUMP CONTROL is shown mounted with compensating spring unit on pump. Timer on control panel actuates control to high pressure setting after dies have come within .010 inch of complete closing. Piping the system with large size, hose eliminates oil cooling equipment and compensates for surges with closed center valves.



PNEUMATIC TIMERS control machine cycle. Time delay is controlled by a variable orifice to meter air into a rubber bellows. Timers have one normally open and one normally closed contact which are actuated after the time delay initiated when the timer is energized.



TOGGLE LINKAGE is actuated by retraction of die closing cylinder to close the dies. Very little force is required until the final squeeze of the dies. Therefore, the pump is compensated at about 150 psi to protect against high forces being applied with an obstruction in the dies. High force is not available until the last .010 inch of travel when the limit switch on top of the stationary die is actuated by the rod on the moving die.

PUMP COMPENSATION

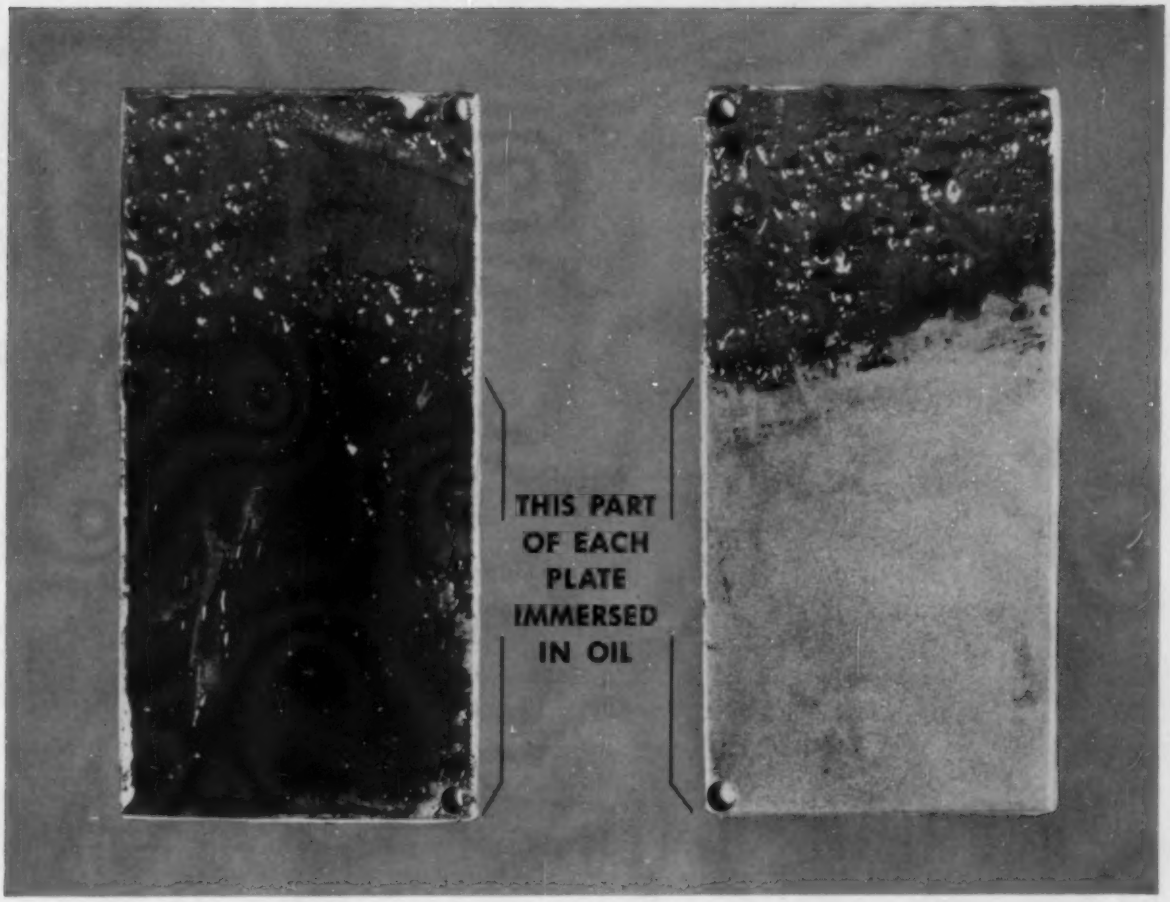
cylinder which acts through a toggle linkage. Each cylinder is controlled by a closed center, solenoid-controlled, pilot-operated valve. No relief valve is necessary. During removal of parts from the press, when the valves are centered, the pump displacement is forced to a near-zero position at the low pressure setting of the compensating spring.

TIMERS CONTROL CYCLE

Three pneumatic timers control actuation of the solenoid controlled valves and the sequencing of the press. These timers have a synthetic rubber bellows for controlling the tripping time after the timer is actuated, and have a range of 1/6 to 180 seconds with an accuracy of approximately $\pm 10\%$. Adjustment of the time delay is made with an adjustable air vent which regulates the opening through which air must pass into the bellows. This controls the time delay for operation of the contacts. An air filter excludes dust particles and other foreign matter.

One of the timers initiates retraction of the mold closing cylinder, which acts on the movable die through a toggle linkage. During most of the die movement the pump is compensated at a pressure of about 150 psi which is sufficient for moving the die to near closed position. Should there be some obstruction in the die, little force could be developed by the die closing cylinder and no damage would result to the die. When the die is within .010 inch of complete closure, a limit switch is actuated to energize the solenoid operated pump control. This applies system pressure as well as spring force to the pump control and permits the pump to develop 900 to 1000 psi for the high force required to pull the toggle mechanism into locked position.

The time during which system pressure is applied to the pump control, and the pump is compensated at the high pressure is controlled by a synchronous motor timer. The timer maintains the pump at the high pressure setting until slightly after the injection cylinder is reversed to insure that the high pressure is available long enough for the injection stroke. ▼▼▼



This sludge-coated metal plate was partially immersed in a beaker containing a *regular hydraulic oil* heated to normal operating temperature. Though the oil was agitated throughout the test, nearly all the sludge remained on the plate.

This similarly sludge-coated plate was partly immersed in a SUNVIS 700 oil, also heated to normal operating temperature. During the same period, with the same degree of oil agitation, the immersed part of the plate was rinsed clean of sludge.

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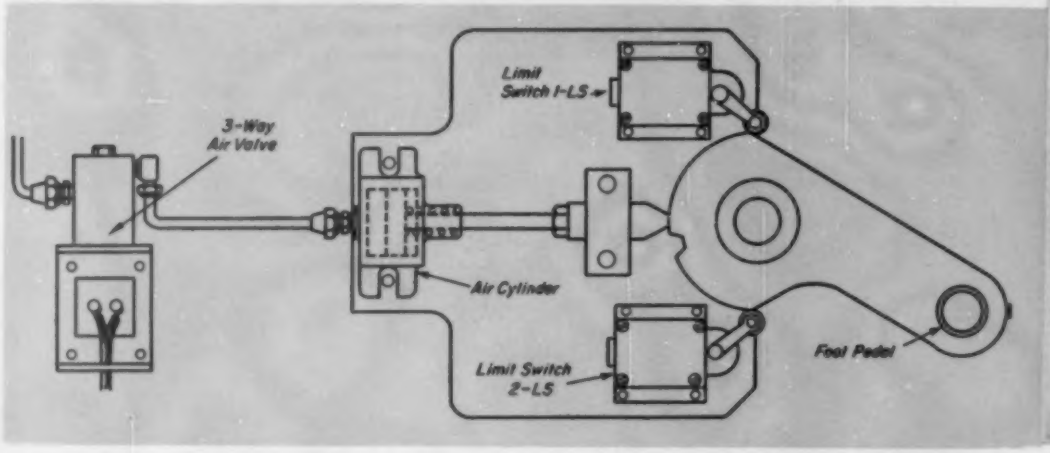
For its primary job of expanding steel rings used in jet engines, this machine requires up to 280 tons, so hydraulics was the only answer. However, for operating a detent which locks the control pedal, an electrically controlled air cylinder was the best design.



PNEUMATIC DETENT . . . *controls expander*

• By Robert Soman

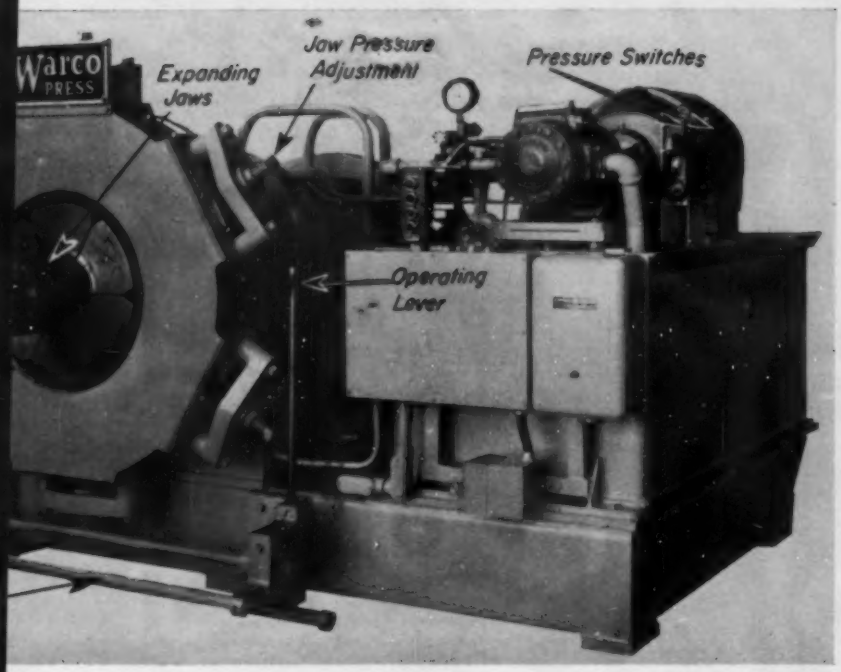
IN ADDITION to designing a special cylinder and wedge mechanism for a ring expanding machine, engineers at Federal Machine & Welder had to work out controls for the manually operated actuating system. The cylinder which expanded the rings with a wedge arrangement was to be controlled by a 4-way valve. The operator's controls were to consist of a lever and pedal mounted together for hand or foot operation.

To actuate the solenoid-controlled, pilot operated 4-way valve, two limit switches had to be mounted so they could sense the position of the operator's lever or pedal. In addition to the manual controls to start the cylinder in the expanding stroke, it was decided to use a pressure switch to reverse the cylinder. This pressure switch would not only function to deactuate the limit switch which was energizing the valve, but would also actuate a second limit switch which would energize the valve for reverse movement of the cylinder.

Deactuation of the limit switch was accomplished by disengaging the air-operated detent allowing the spring-loaded manual control to return to its neutral position. Using a small spring-loaded air cylinder of 2-9/32-in. bore and 1-in. stroke, controlled by a 3-way solenoid-operated valve, the detent can be withdrawn when the pressure switch is actuated at the end of the expanding stroke of the cylinder. Withdrawing the detent permits the spring-loaded lever pedal to return to neutral, deactuating the one limit switch and actuating the other limit switch. Inching of the cylinder is accomplished by moving the lever to either side of neutral.

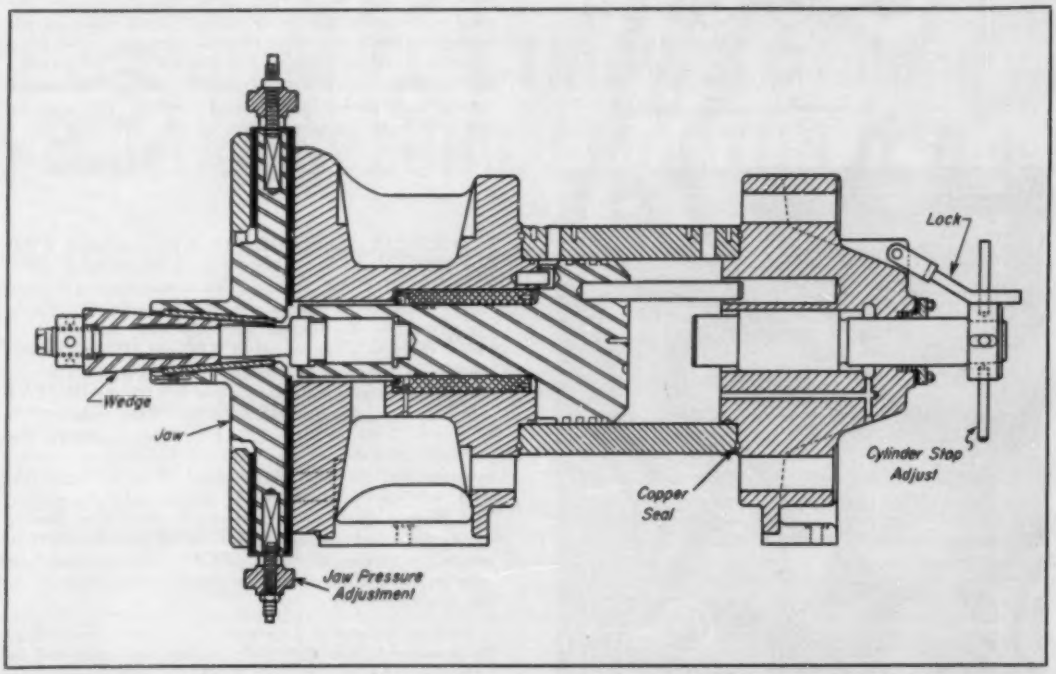
To permit a fast closing and return of the 20-inch cylinder, and at the same time minimize pump cost and power requirements, a hi-lo circuit is used with a 36-gpm axial piston pump and a 33.5 vane

ROBERT SOMAN, *Asst. Chief Engineer, The Federal Machine & Welder Co., Warren, Ohio.*



PNEUMATIC DETENT is actuated by a 2-9/32-in., spring-loaded air cylinder controlled by a solenoid-operated, 3-way valve. Valve is energized by a limit switch actuated when the pedal is pushed down by the operator. At the end of the working stroke of the cylinder, the valve is de-energized allowing the air cylinder to retract and remove the detent. Spring-loaded pedal then returns to its starting position. For jogging, the circuit to the valve is opened and the detent is not operative.

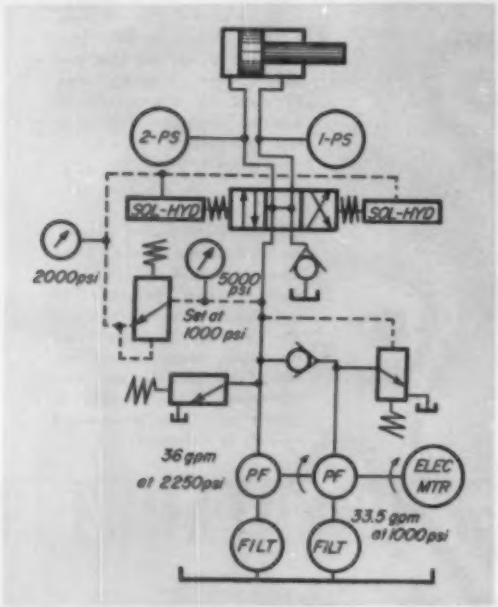
STEEL RINGS are placed on machine jaws which are expanded by the wedge when pressure is applied to the rod end of the cylinder. After the operator steps down on the foot pedal, an air-operated detent holds it down until a pressure switch is actuated.

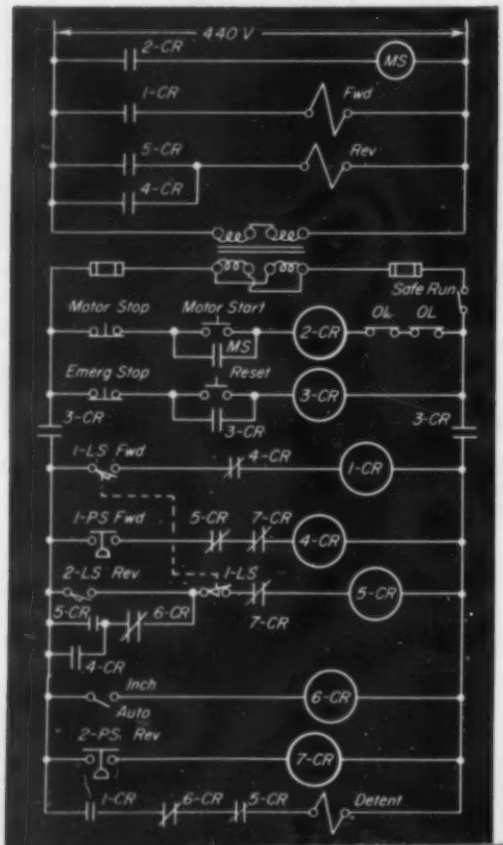


HYDRAULIC CYLINDER for the expander has a piston forged in one piece to minimize the tendency to break the piston off the rod, since the greatest force is developed by the cylinder on its retract stroke. The forward end of the piston rod is threaded to receive different size wedge-jaw assemblies. The handwheel at the head end of the cylinder adjusts stroke length to a maximum of 8 or 11 inches on two models. The handwheel is locked in placed by a hinged stop. Pins in the rod end of the cylinder and in the piston guide the piston and prevent any rotation. Seals for the piston and rod are metal piston rings, and a mechanical seal is also used for the rod.

pump. A pressure reducing valve is connected to the main system and set at 1000 psi to supply pilot pressure for operation of the 4-way valve.

The machine is designed to stretch welded steel rings of 60,000 psi tensile strength. The rings can be stretched from 14 inch ID minimum to 36 ID maximum by changing jaws. The machine wedges are designed with a taper of 1 inch in 12 inches giving a mechanical advantage of 6. ▼▼▼





Calculating Cylinder Size

Taper of wedge = 1 in/12 in

Tensile strength of steel = 60,000 lb/in²

Pressure = 2250 lb/in²

Stretching force = 1 in x 10½ in x 60,000 lb/in² x Z
= 1,260,000 lb

$$\text{Pull force} = \frac{1{,}260{,}000 \text{ lb}}{.50 \times .75 \times 6}$$

= 560,000 lb

$$\text{Required area} = \frac{560{,}000 \text{ lb}}{2250 \text{ lb/in}^2}$$

= 250 in²

Piston Area (20-in dia.) = 314 in²

Rod area (9-in dia.) = 64 in²

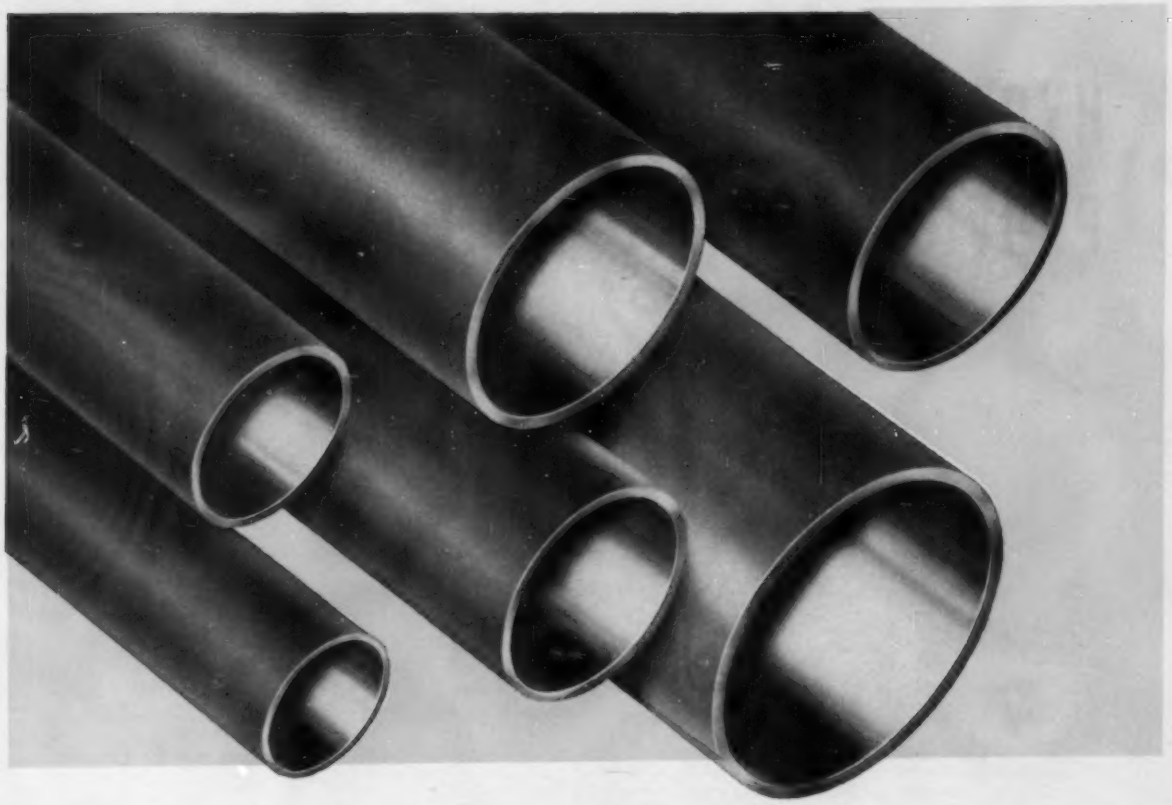
Effective area = 250 in²

Note: Coefficients of friction are based on practical experience.

HYDRAULIC CIRCUIT connects two pumps in a hi-lo circuit for high speed operation at minimum cost. With both pumps delivering to the system, retracting speed of the cylinder is 65 ipm. When work is contacted, pressure rises above 1000-psi setting of unloading valve and 33.5-gpm pump is unloaded to tank. The 36-gpm pump continues to supply the cylinder moving it at a speed of 34 ipm. Pressure reducing valve is set for 1000 psi to supply the pilot sections of the 4-way valve. Check valve in the drain line from the valve insures adequate pilot pressure when the valve is centered to unload the pumps. The pressure switches actuate the solenoids to reverse the cylinder at the end of its retract stroke and stop it at the completion of the cycle.

ELECTRICAL CONTROL CIRCUIT, includes FWD and REV solenoids of 4-way valve controlling cylinder, and DETENT solenoid of 3-way, spring-loaded valve controlling pneumatic detent cylinder. Pushing down on the pedal actuates limit switch 1-LS which in turn actuates the FWD and DETENT solenoids. When pressure switch 1-PS is actuated at the end of the stretching stroke, the FWD and DETENT solenoids are deactuated, and the REV solenoid is actuated. This returns the piston and allows the pedal to return. At the end of the return stroke, pressure switch 2-PS is actuated to de-energize the REV solenoid and allow the 4-way valve to center. The pumps then unload through the valve during loading. Positioning the INCH-AUTO switch to INCH, opens the circuit to the DETENT solenoid and permits actuation of the 4-way valve solenoids only by the limit switches.

Solenoids for the 1½-inch 4-way valve, as well as the contractor for the 40-hp motor, are operated on 440volts. The EMERGENCY STOP switch opens the circuit to relay 3-CR de-energizing the solenoid controls and allowing the 4-way valve to center. Connecting the primary of the control transformer in series and the secondary in parallel provides a stepped down voltage of 110 volts for the control components in the secondary circuit.



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HYDRAULIC CYLINDERS PROVIDE ROTARY MOTIONS

. . . on a pipe handling table

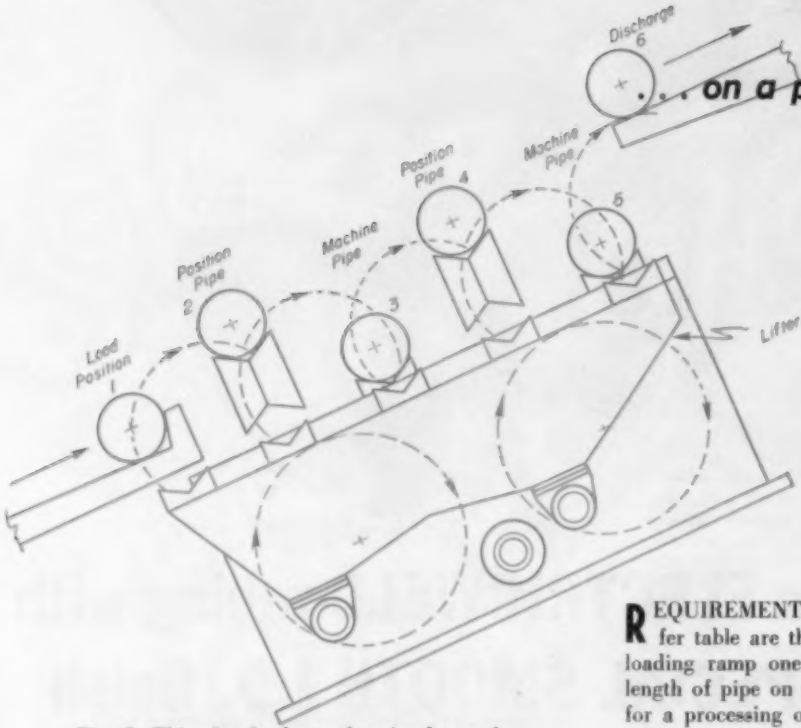


Fig. 2. This sketch shows the circular paths followed by the pipe-holding notches in the lifter plates, the six positions through which the pipe is moved and the circular paths followed by the crankpins driving lifter plates.

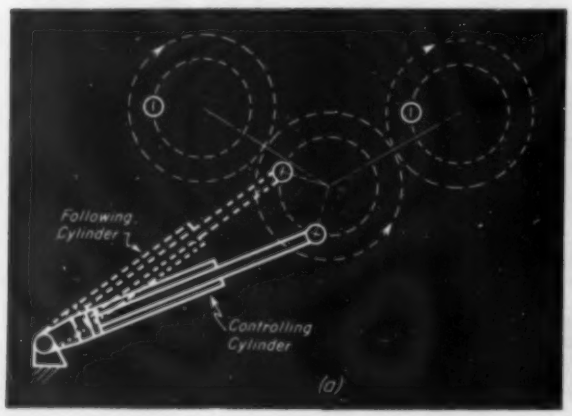
Fig. 3. Dwell position and three intermediate positions of the cylinders and gears driving the lifter plates. Dwell position is at *a*. Succeeding intermediate positions are at *b*, *c*, and *d*.

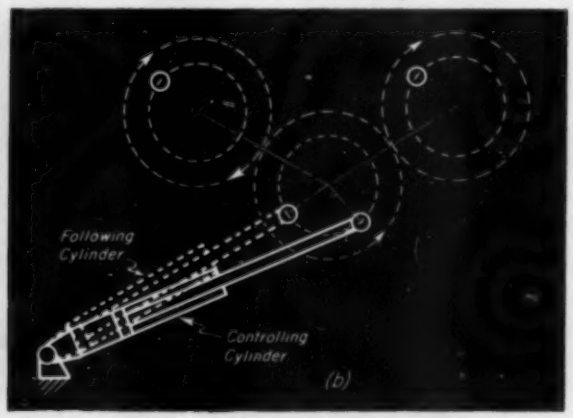
● By Laverne E. Erikson

REQUIREMENTS for an automatic pipe transfer table are that it lift lengths of pipe from a loading ramp one at a time; and then place the length of pipe on rolls which feed it to a machine for a processing operation such as threading, facing, chamfering or reaming. The pipe is then lifted and repositioned for a similar operation on the other end of the length after which it is placed on a discharge ramp.

These requirements were translated into the auto-

LAVERNE E. ERICKSON, *Design Engineer, Machinery Div., Pipe Machinery Co., Wickliffe, O.*





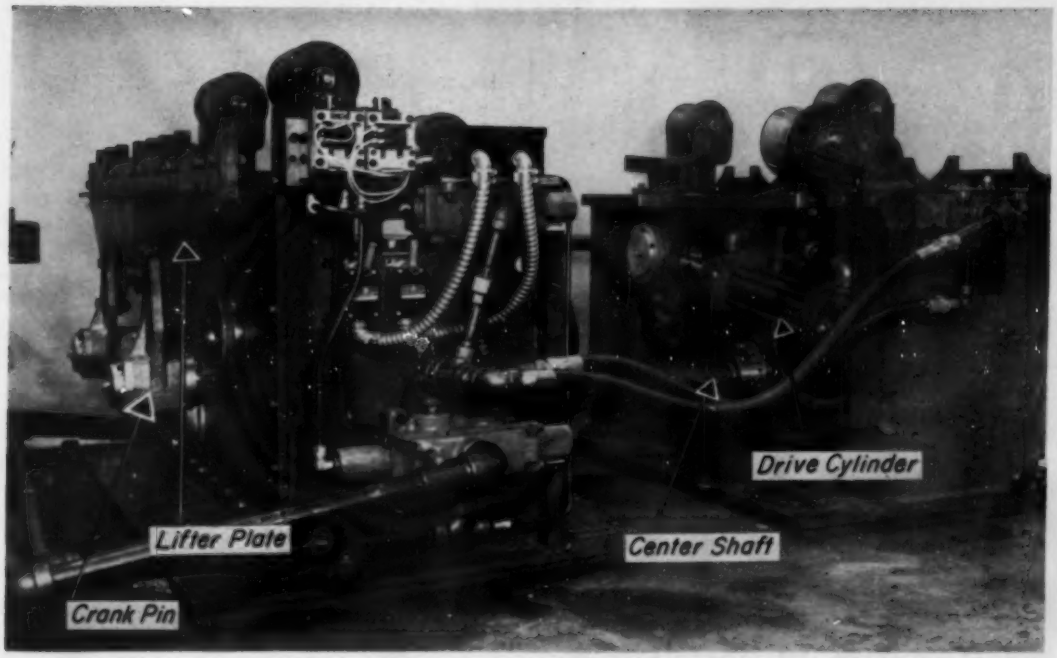
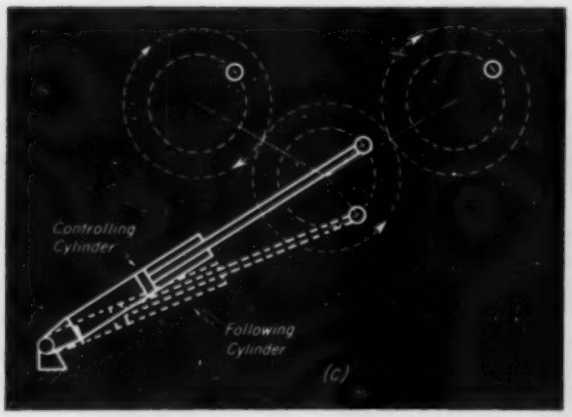


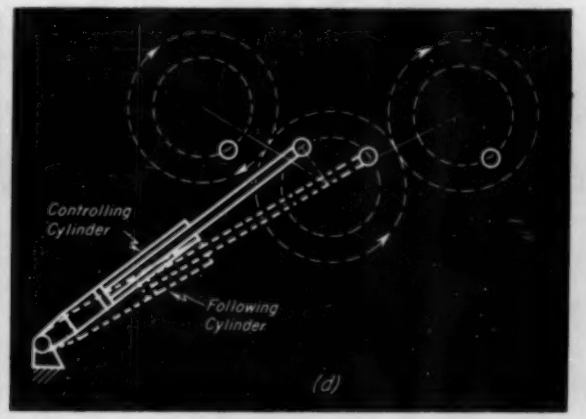
Fig. 1. A hydraulically-operated automatic pipe transfer table consists of two stands whose spacing may be varied to allow handling of various lengths of pipe. Pipe is moved from loading position through two machining positions and then unloaded.

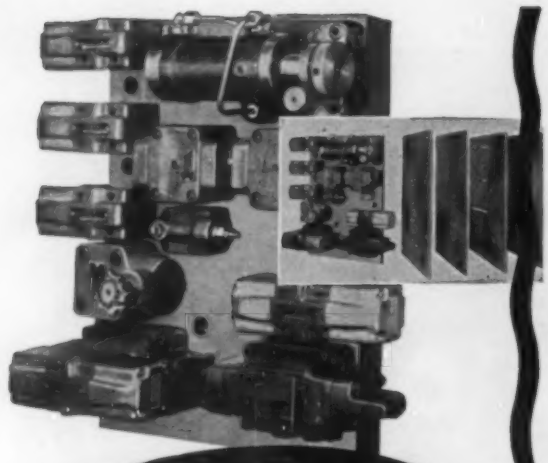
matic transfer table shown in Figure 1. The table consists of two stands which can be placed at varying distances from each other to allow processing of various lengths of pipe. A sketch, Figure 2, shows the actual operating sequence. Sequence of operations is:

1. Lift pipe from loading ramp and place upon positioning rolls.
2. Place pipe in machining position.
3. Lift pipe from machining position and place upon rolls for positioning other end.
4. Lift from positioning rolls and place in position for machining other end.
5. Lift from machining position and place on discharge ramp.

As indicated in Figure 2, these operations are performed by lifter plates incorporating five V-notches. The plates rotate through 360 deg and then dwell while the positioning and machining operations are being performed. Travel path of the notches in the lifter plates coincides with rolls or holding notches in which the pipe must be placed. As the lifter plates rotate, pipe is automatically placed in position in the appropriate notch or roll. Geometry of the lifter plates and rolls or holding







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notches is such that each time the lifter plates rotate, the pipe is picked up by the next successive notch and placed in the next position.

• **Rotating Mechanism**—Lifter plates are rotated by crankpins on the outer two gears of a three-gear train, Figure 3. There is one such gear train in each of the stands making up the table. Central or driving gears in the two stands are connected by a shaft. Gear trains are driven by hydraulic cylinders through crankpins on the driving gears. One cylinder is located in each stand and the crankpins through which the cylinders drive the gear trains are spaced 90 deg from each other.

Hydraulic cylinders rather than other available means were chosen for this application because they provide fast, shock-free acceleration. Although other types of actuators might be capable of higher ultimate speeds when rotating continuously, the

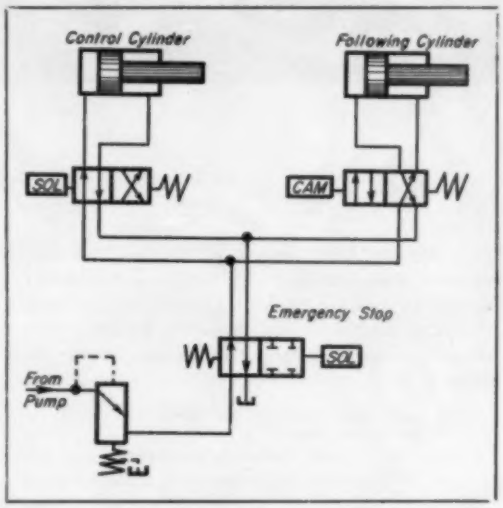


Fig. 4. Hydraulic circuit diagram of the automatic pipe transfer table.

cylinder drive provides shortest cycle time for the 360 deg and dwell cycle.

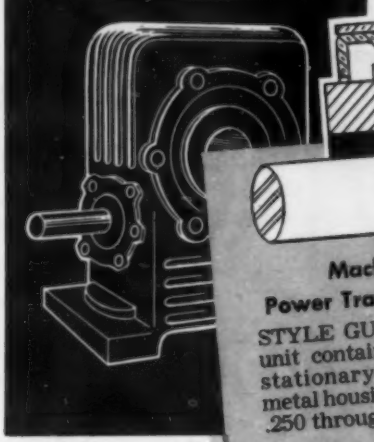
When the machine is in the dwell position, Figure 3*a*, pressure is applied to the rod ends of both cylinders through two-position, four-way valves, Figure 4. Since both cylinders are tending to rotate the gear in opposite directions, they balance each other and there is no rotation. To initiate the transfer cycle, an electrical signal is applied to the solenoid of the control cylinder valve. This causes pressure to be applied to the blank end of the control cylinder and initiate rotation since both cylinders are now tending to rotate the gear in the same direction.

When the following cylinders is fully retracted, pressure to the cylinder is reversed by a cam-oper-

Concluded on page 100

Circle 8 on Reader Service Card

Circle 55



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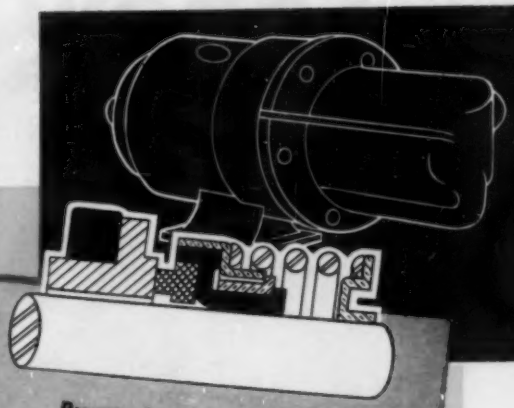

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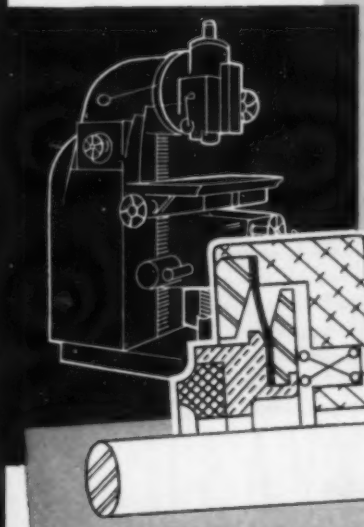

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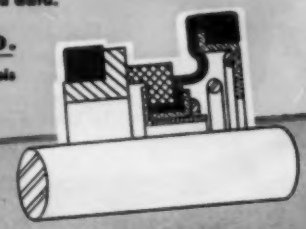

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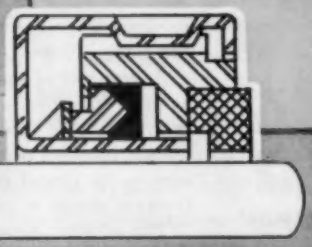

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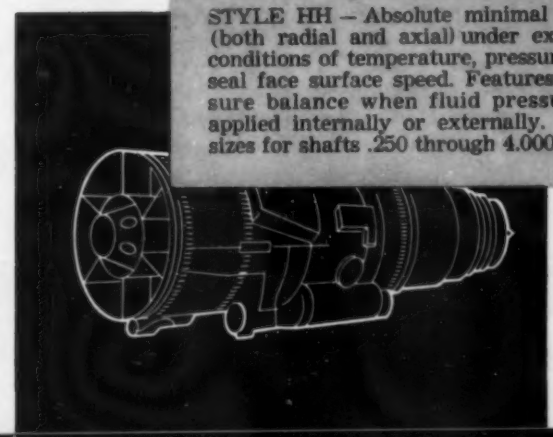

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ROTARY MOTIONS FOR PIPE HANDLING

ated valve, Figure 4, to extend the cylinder and cause it to continue to drive the pin and gear. As shown in Figure 3*b*, this is just a bit past dead center so the cylinder will not tend to reverse rotation of the gear. When rotation has progressed to the point where the controlling cylinder is fully extended, Figure 3*c*, a cam-operated limit switch breaks the circuit to the solenoid and pressure is then applied to the rod end rather than the blank end of the controlling cylinder.

As the following cylinder reaches its fully extended position, Figure 3*d*, a cam operates the four-way valve to apply pressure to the rod end. Both cylinders are now aiding, but as soon as the following cylinder crosses dead center in its fully retracted position, it opposes rotation of the gear. As soon as a position is reached where the products of the cylinder forces and their crank arm lengths are equal, the system automatically stops, Figure 3*a*.

• **Hydraulic Circuit**—Since the hydraulic power source is also used for clamping and other functions on the pipe processing machine, the transfer table circuit, Figure 4, includes a sequence valve to insure that necessary operations are performed by the machine before pressure is applied to the table circuit. The emergency stop valve is included to allow the operator to stop the transfer machine at any point in the machine cycle either because of an emergency or for setup purposes. ▼▼▼

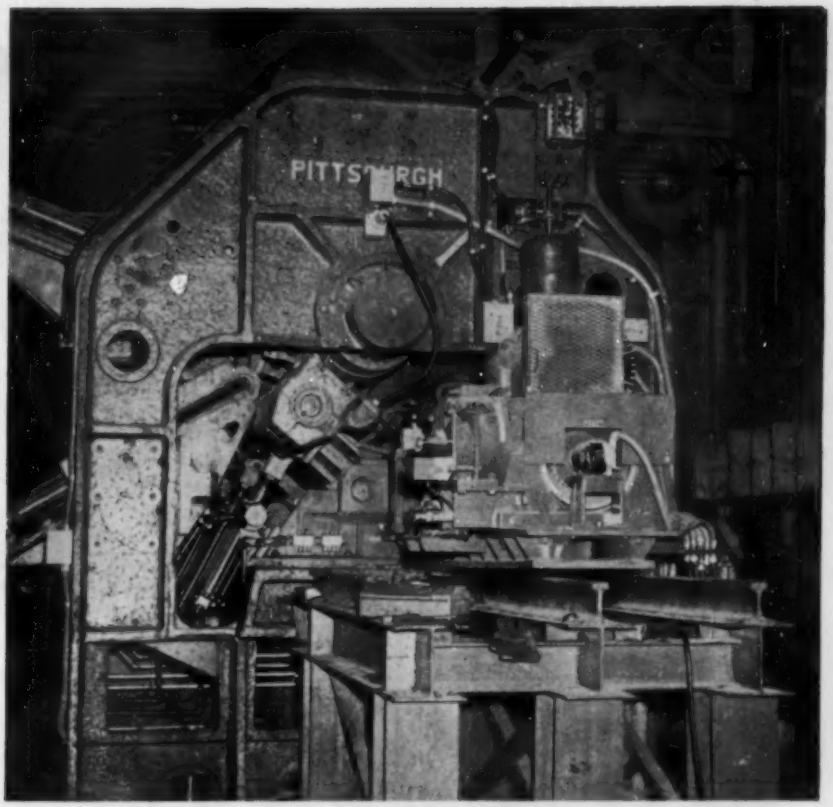
EXTRUSION PRESS DESIGN

Concluded from page 78

contacts the billet, pressure buildup operates the sequence valve to connect the main ram to the pressure line. The prefill valve is then seated and the extrusion stroke proceeds.

At the end of the extrusion stroke, the operator reverses the four-way to retract the platen. The sequence valve then closes and the prefill valve is opened by pilot pressure to allow fluid in the main ram to be forced directly back to tank as the retraction stroke is in process.

The smaller press uses only shear, container and extrusion cylinders. No kicker cylinders or prefill system are used. On the retraction stroke, a solenoid-operated check is opened during the greater part of the stroke to allow fluid to be forced directly back to the tank. The line between the cylinder and the tank is much larger than the tank line from the control valve, so very little fluid actually passes back to tank through the valve although this connection is made as indicated by the circuit diagram. As the platen nears the end of the retraction stroke, the check valve is closed by a limit switch, so during the final portion of the stroke fluid is returned to tank through the four-way valve. ▼▼▼



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Pictured here is a coiler which takes hot steel strip as it comes from the rolling mill at 1500 feet per minute, and winds it on a mandrel to produce a tightly and evenly wound coil measuring up to 48" wide, 59" in diameter, and weighing about 20,000 pounds.

Various parts of the machine essential to winding and handling the coil are hydraulically operated by equipment designed and built by Benjamin Lassman & Son. The high pressure hydraulic control system, engineered by Lassman, provides smooth, shockfree, leakproof operation.

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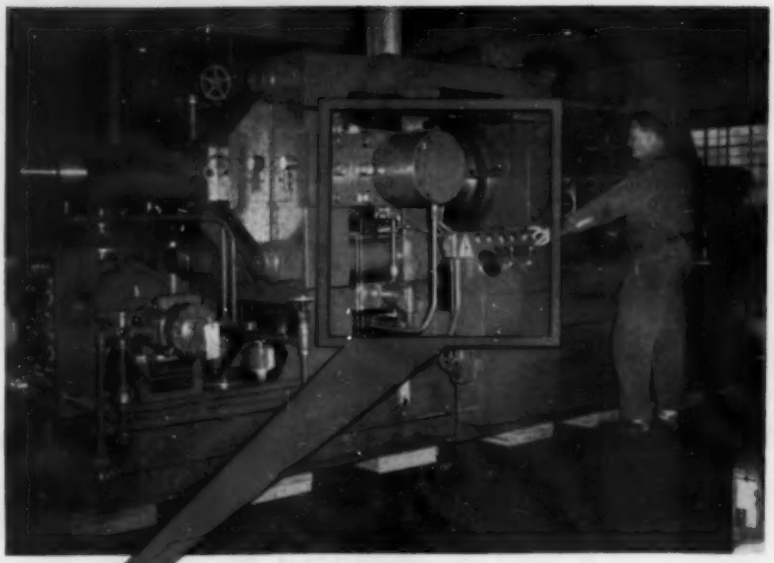
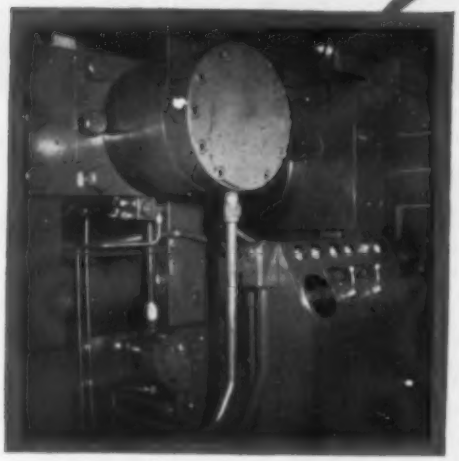
LOCKING the dies in place in accomplished by wedges driven by the 10-inch cylinders mounted perpendicular to the closing cylinder. 2000-psi, 2-stage pump which powers the wedge cylinders is built into the base. Both closing cylinder and die cylinder have been modified from standard units to include an adjustable stop.



HYDRAULIC MOTORS have solved the synchronization problem. Although the motors accelerate and decelerate almost instantly, connecting them through a flexible shaft coupling has eliminated torsional stresses in the connecting shaft.



On this die casting machine, dies of unsymmetrical shapes produce unequal loading on the two wedge cylinders which lock the dies in place. Although several of the conventional methods of synchronizing were contemplated the method chosen was the use of two fluid motors coupled together to meter fluid to and from the wedge-locking cylinders.

FLUID MOTORS SYNCHR

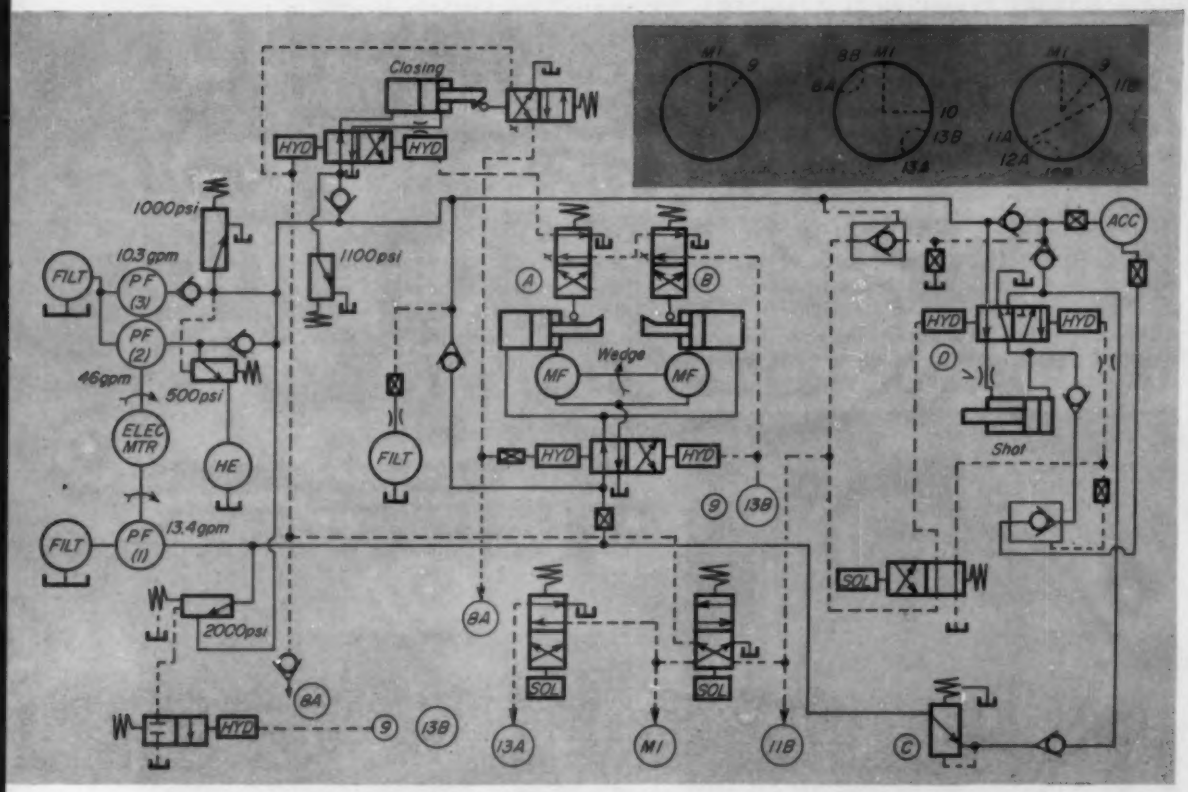
● By John Perkon

A WEDGING action which locks the dies together under forces up to 750 tons has proved very effective in a die casting machine developed by Cuyahoga Industries Inc. However, varied distribution of projected die area causes the wedge-locking cylinders to be loaded unequally. If no synchronization method were used, fluid pressure would build up to the value required to move the lighter loaded cylinder, extend it to its extreme position, and then build up to the value required to move the higher loaded cylinder. This condition would produce an unequal strain on the machine.

JOHN PERKON, *Chief Engineer, Cuyahoga Industries, Inc., Cleveland, Ohio*

SYNCHRONIZATION DEVELOPMENT

The first synchronization method which was designed was to link the two cylinders together mechanically. When this design was drawn up, it was realized that it would be too complicated to install,



PARTIAL HYDRAULIC SCHEMATIC indicates some of the unusual features of the circuit. Connecting the 1000-psi pressure line to drain of 13.4-gpm pump relief valve allows flow from the 13.4-gpm pump to go to the 1000-psi line when the high pressure relief valve is vented. Cam-actuated valves *A* and *B* control opening of the die closing cylinder. Both valves must be actuated with the wedge cylinders completely open before the closing cylinder can retract. Pressure reducing valve *C* regulates pressure applied to shot cylinder from 2000-psi line. Flow control valve *D* controls speed of this cylinder. Pilot lines terminating with numbered arrows are connected to rotary valve not shown. Also not shown are circuits for ejector cylinder and core pull cylinders. Diagrams in shaded area show connections made by rotary valve which selects different operations of the core cylinders in each position.

ONIZE CYLINDERS ... *with unequal loading*

because of the amount of space it would require. In addition it would present a maintenance problem, especially since it would not be easily accessible.

A second approach was the use of adjustable flow control valves to meter fluid from the cylinders. Although this eliminated the mechanical disadvantages of the linkage system, it would be necessary to readjust the valves for each set of dies installed in the machine. Not only would this be a time consuming operation, but it would depend largely on the skill and judgment of the operator.

A flow divider was also considered in solving the synchronization problem, but the idea was discarded in favor of fluid motors acting on the same principle but permitting faster operation. The motors have a displacement of 2.3 cu. in./rev.

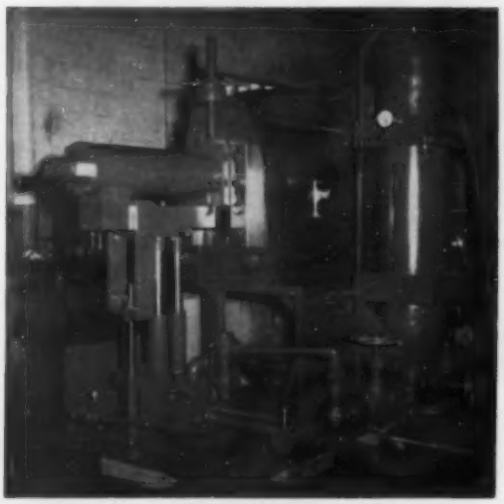
Acceleration and deceleration of the motors was almost instantaneous, and this produced high forces in the key which solidly connected the two shafts together. To alleviate this, a flexible shaft coupling

is used to reduce the torsional stresses. Because the type of coupling used in this application has freedom from backlash and high torsional rigidity, synchronization is maintained the same as with the solid coupling.

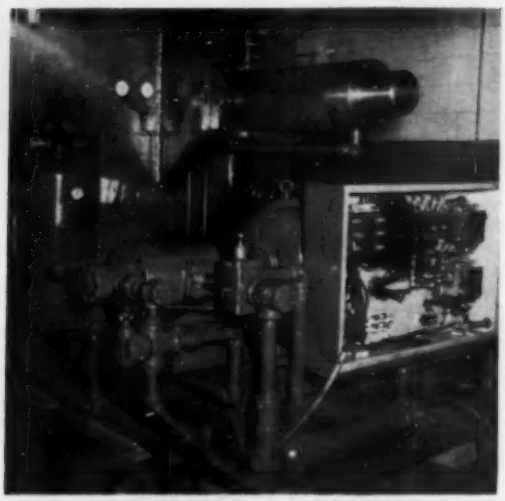
HYDRAULIC EJECTION

An outstanding feature of this die casting machine is the hydraulic ejector and hydraulic core pulls. To simplify selection of the method of operation—with no hydraulic core pulls, with the cover core pull, with ejector core pulls, or with bolt—a selector valve has been designed by the company. This is a rotary type valve marked for the different operating methods. Position 1 is used when there are no core pulls. In position 2, cover core pulls are retracted automatically before the machine opens. In position 3, all cores are operated manually.

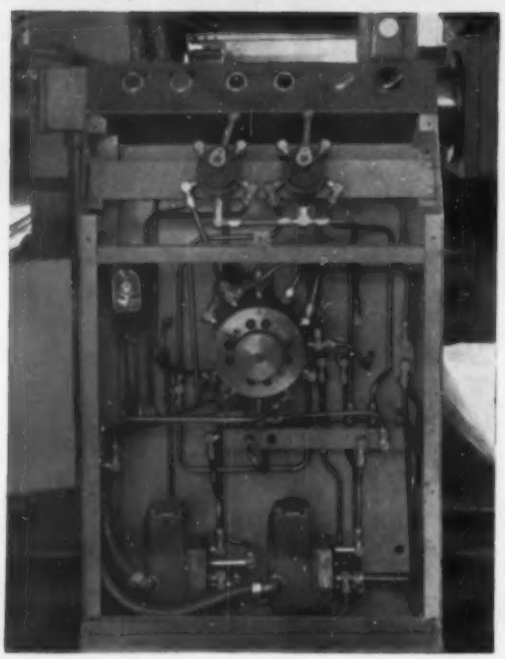
This valve was originally designed as a sliding flat-plate type. Although this was a vast improvement over the old method of opening and closing hand valves to select operation, with the synthetic fire-resistant fluid which is used in this machine, this type of valve had a tendency to stick after periods of inoperation. The rotary valve has eliminated this difficulty. ▼▼▼



SHOT CYLINDER can be raised and lowered by a hand wheel adjustment. Telescoping joints connect fluid to the cylinder to accomodate various die sizes. 30-gallon accumulator to speed action of the shot cylinder has no separation between gas and fluid.



ELECTRICAL CONTROLS are installed in a panel mounted with the hydraulic power unit. Five solenoid valves control separate, pilot-operated valves in the hydraulic system. The 46-gpm pump and 10.3-gpm pump are shown mounted in tandem at one end of the 30-hp motor. The filter shown at left is connected in a bypass circuit from the 1000-psi line through an orifice to drop the pressure on the filter. The heat exchanger is visible below the electrical panel.



ROTARY VALVE to select operation of the machine is installed in the control pedestal which also houses two rotary 4-way valves and electrical pushbuttons. Both flare and flareless fittings are used in many of the tubing runs. This simplifies installation and prevents any strain on the tubing.

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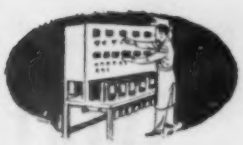

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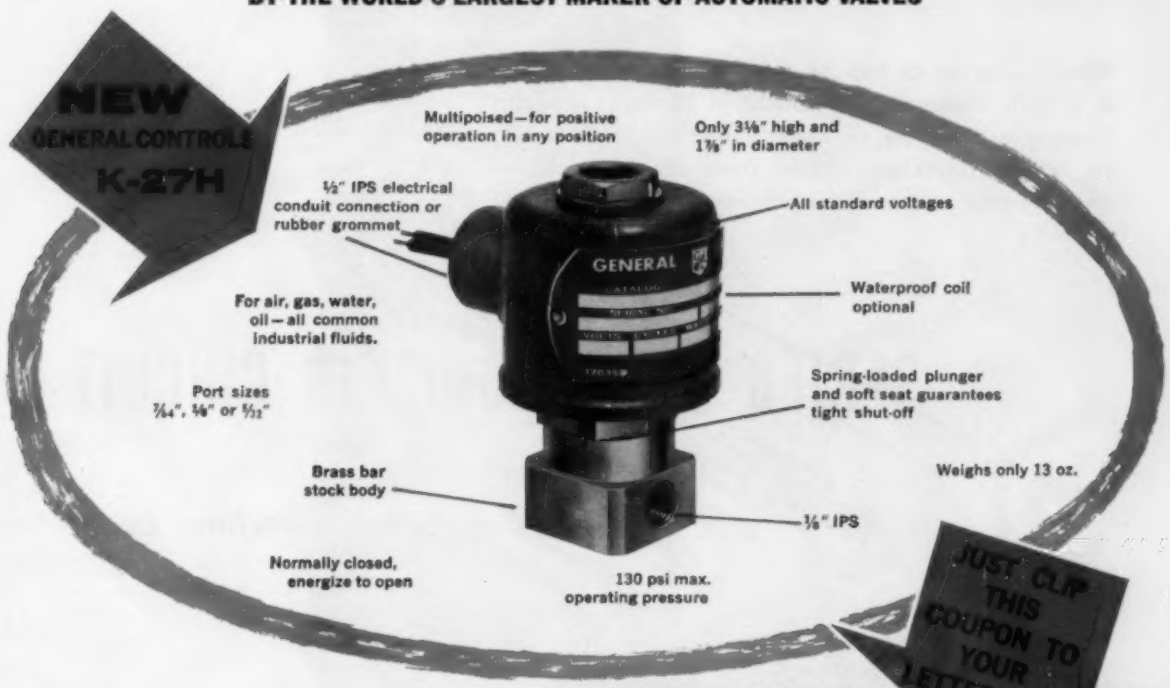
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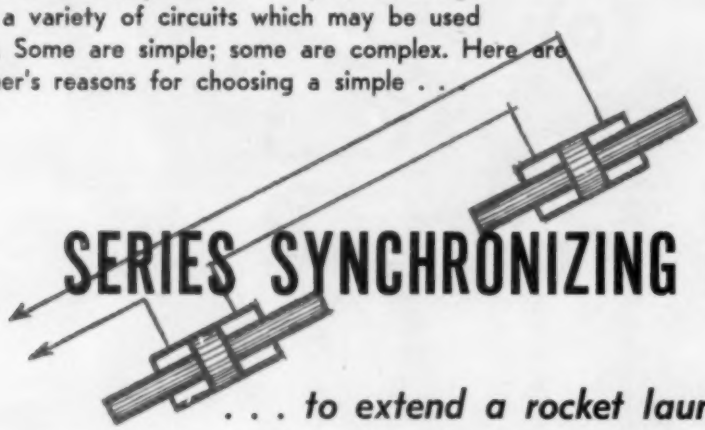
Synchronization of two or more hydraulic cylinders is a fairly common requirement in hydraulic design. There are a variety of circuits which may be used to do this. Some are simple; some are complex. Here are one designer's reasons for choosing a simple . . .



SERIES SYNCHRONIZING CIRCUIT

. . . to extend a rocket launching beam

• By E. Ashley

IN SERIES connected synchronizing circuits, the outlet port of one cylinder is directly connected to the inlet port of the next. As the first piston moves, a volume of oil equal to the displacement of the first piston is forced into the second cylinder. If the connected working areas are equal, the two cylinders move in unison. By using different working piston areas, two or more cylinders can be made to move with a fixed ratio existing between them. For example, if one piston had twice the area of the other, the piston with the larger area would always move just half as far as the other.

E. ASHLEY, *Design Engineer, Aircraft Products Dept., General Electric Co.*

• **Advantages**—A series circuit has various advantages. Control is simple. A single four-way valve may control any number of cylinders. Variations in load have no effect upon synchronization. Fluid trapped between cylinders represents a fixed volume spacer between the pistons and no relative motion is possible barring leakage. A piston which has no load at all will, therefore, remain synchronized as long as the load variation does not affect leakage.

Another advantage of the series circuit is that it requires no metering devices to maintain equal flow rates to the cylinders. Such devices are relatively expensive and add to circuit cost. Also they may in time cease to function as accurately as may

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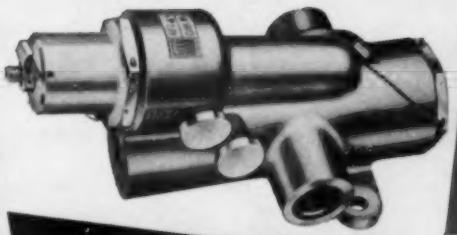


Here's just one example of the many types available!

be required due to wear of the moving parts. Flow dividers are also sensitive to contamination of the hydraulic fluid.

• **Limitation**—To fairly present both sides of the picture, it must be granted that series circuits do have their limitations. These limitations must be considered and minimized or overcome by effective design when possible.

One of the most important limitations of the series synchronizing circuit, which must be taken into account very early in the process of designing such a circuit, is that pressure drops are additive. Thus, if three cylinders were to be synchronized and a 3000 psi pump were to be used, maximum pressure drop across each cylinder would be limited to 1000 psi, assuming equal loads on the cylinders. Consequently cylinders for use in a series circuit would have to be larger than those in a parallel circuit if loads were equal.

When single-ended cylinders are used in a series circuit, areas of the rod end of one cylinder and the blind end of the other must be equal, Figure 2a. Finding these cylinders might be difficult. With all areas fixed by the load requirements of the smaller cylinder, the other might have to be considerably larger than the load actually dictates. Also, with such an arrangement, if pump volume were fixed, extension of the cylinders would be much slower than retraction. This is, of course, true when only a single cylinder is used but the difference in extension and retraction rates with series connected cylinders is cumulative. In the case of the cylinders shown in Figure 1—extension and retraction rates would be in direct proportion to areas 1 and 4.

In cases where the circuit requirement is for extension of one cylinder while the other is being retracted, single-ended cylinders will work very nicely and may be identical. When both must extend and retract together, double-ended cylinders are preferred for the reasons discussed. Overall length of the double-ended cylinder is always going to be more than that of a single-ended cylinder of equal stroke, however.

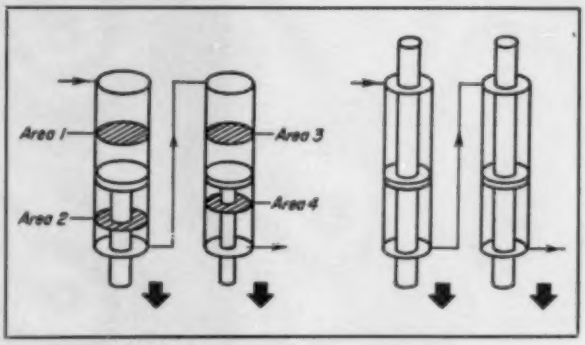


Fig. 1. Double ended cylinders are often used in preference to single ended cylinders in a series synchronized circuit. For single ended cylinders, area 2 must equal area 3. This is difficult to get. Also for a fixed flow volume retraction and extension speeds vary when using single ended cylinders.

• **Cylinder Registration**—Effects of leakage and thermal expansion or contraction must also be considered in a series circuit. Leakage flow in or out of the portion of the circuit between the first and last pistons in the circuit will cause a shift in relative position of the pistons. This effect is cumulative and is not self correcting at the end of each stroke. Thermal expansion of the fluid in this portion of the circuit will have the same effect. Two suggested methods for eliminating this particular difficulty automatically register the cylinders at the end of each stroke. Both can be applied to any

Rocket Launching Application

An actual design problem illustrates the application of a series synchronized circuit. Requirement was for a 12-foot launching beam to be extended outside the skin line of an airplane for launching a missile. After launching the beam was to be retracted. Extension stroke requirement was about 4 ft. Beam structure and supports are of minimum weight and consequently not sufficiently stiff to permit using nonsynchronized actuators. Flexibility of the structure would permit as much as 1 in. misalignment during extension and retraction. However, accurate positioning at both ends of the stroke is an absolute necessity since extended position of the beam affects launching accuracy and structural clearances had to be maintained when the beam was retracted. Finally, the system had to be reliable in view of the fact that its location on the aircraft did not permit its operation to be visually monitored by an aircrew member.

All these requirements were successfully met by the system shown schematically on the right. A single control valve is used. Accurate positioning, both when extended and retracted, is provided by the limit switch control of Figure 2. To limit flow requirements and at the same time keep stroke time to a minimum, a form of double-ended cylinder is used. Actually, the cylinders are folded and do not have a rod extending from both ends since the 8 ft clearance required for cylinders with a stroke of 4 ft is not available in the airframe.

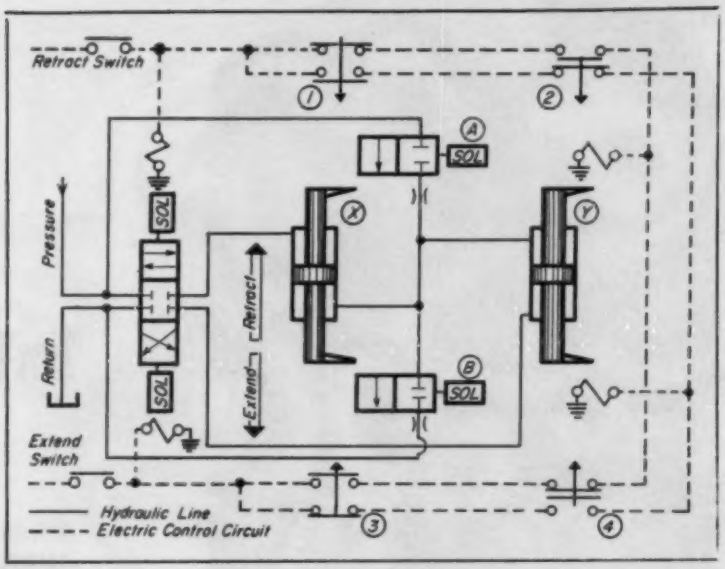


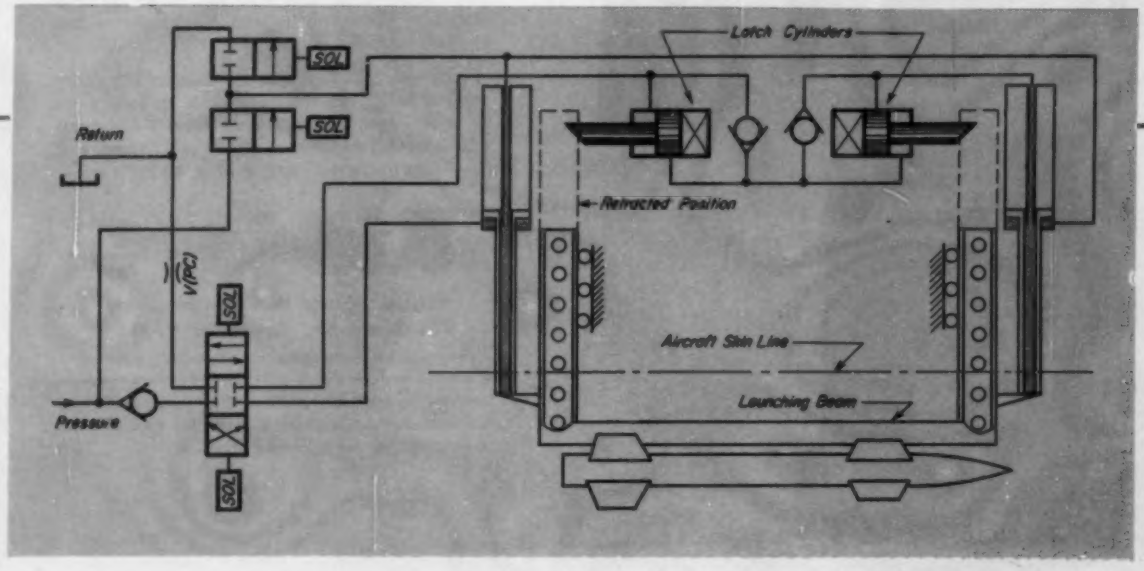
Fig. 2. Since any change in the volume of oil between the cylinders in a series synchronizing circuit will produce an out-of-step condition, means for automatic registration of the cylinders at the ends of the stroke must often be used. In the circuit at *a*, limit switches and solenoid valves are used to do this. If cylinder *X* leads cylinder *Y* on the extension stroke, the circuit to the coil of solenoid *A* will be completed through the normally open contact of limit switch 3 and the normally closed contact of limit switch 4. This will open valve *A* and allow oil to pass through the line connected to valve *A* to cylinder *Y* until it reaches the end of its stroke and opens the normally closed contact of limit switch 4, breaking the circuit to solenoid *A*. In the event cylinder *Y* were leading cylinder *X* on the extend stroke, the circuit to solenoid *B* would be completed through the normally open contact of limit switch 4 and the normally closed contact of limit switch 3. This would open vent valve *B* and permit cylinder *X* to complete its stroke. The process is similar for the retraction stroke except limit switches 1 and 2 control the valves. Orifices in series with the vent and replenishing valves maintain pressure to keep the cylinder which has reached the limit of its travel in position.

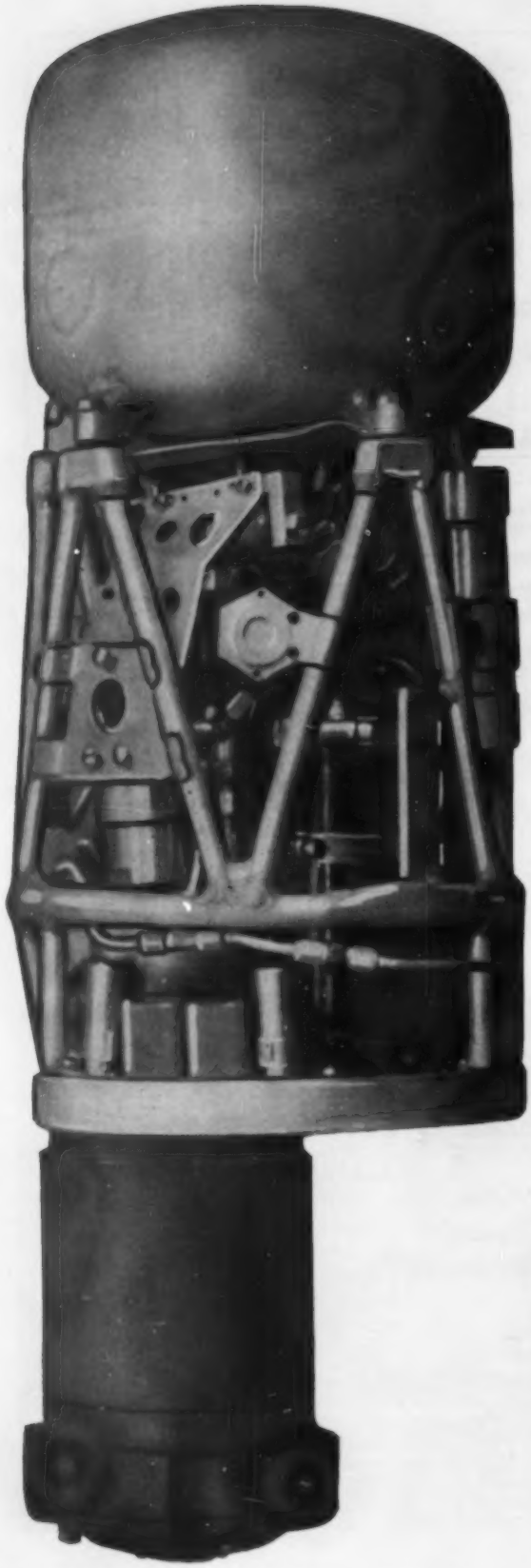
number of cylinders in series. For illustrative purposes only, two cylinders in series will be considered.

In the first method, Figure 3, limit switches are positioned at both ends of each cylinder. The switches operate solenoid valves to allow the lagging cylinder to complete its stroke. Mechanical bypass valves are used in the second method, Figure 4, to achieve the same result. These circuits will maintain very good alignment while the cylinders are operating and will correct on the first operating stroke for any misalignment which may occur during idle periods.

There are applications where alignment on the first operating stroke after an idle period is a requirement. In such cases, positive mechanical latches can be provided for each cylinder. The

Concluded on page 114





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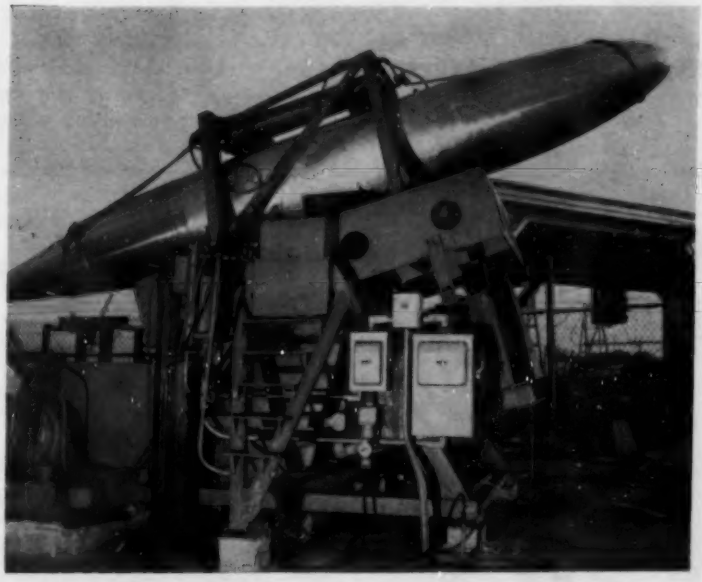
External fuel tanks for both jet and propellor driven military aircraft must pass rigid vibration and slosh tests to insure satisfactory performance in flight. Vibration generator drive requirements for such a machine are well matched by the characteristics of an adjustable-speed hydraulic transmission.



HYDRAULIC DRIVE AND CONTROLS

. . . help test aircraft fuel tanks

● By Davis Hutchinson

Chief Vibranetics Div., Century Engineers Inc., Burbank, Calif.

STEPLESS speed variation, wide speed adjustment range, relatively small size of a hydraulic motor and the comparative safety of a hydraulic transmission were factors in the selection of a hydraulic adjustable-speed transmission for use in slosh and vibration testing machine for aircraft fuel cells.

In the testing of aircraft fuel cells, wing tank is partially filled with fuel or water, mounted on a simulated wing structure, and then simultaneously rocked and vibrated. The rocking and vibration simulate actual flight conditions. Rocking, of course, causes the liquid in the tank to slosh back and forth and produce impacts on bulkheads, frames, and nose and tail sections such as occur during aircraft flight.

Typical test procedures consist of vibrating the tank at a total excursion of 0.032 in. at 2000 cycles per minute for jet-powered aircraft. Vibration frequency is 90 percent of crankshaft speed for tanks intended for use in propeller-driven aircraft. Slosh amplitude is 15 degrees to each side of the level position. Slosh frequency is 10 to 20 cycles per minute. The test is run for 25 hours for Class I tanks and 10 hours for Class II tanks. Any leak or failure occuring during the test period is cause for rejection.

The machine described in this article was developed for use at Wright Air Development Center for tests of this nature and for development work. It is capable of testing a tank up to 45 feet

long weighing 20,000 lb including the test fixture. Mass moment of inertia of tank and fixture may be as much as 50,000 lb ft sec^2 and the center of gravity may be as much as four feet above the mounting surface. The machine can vibrate the test tank at frequencies from 1200 to 3300 cycles per minute with total excursion ranging from zero to 0.050 in. Slosh angle is variable from 16 to 30

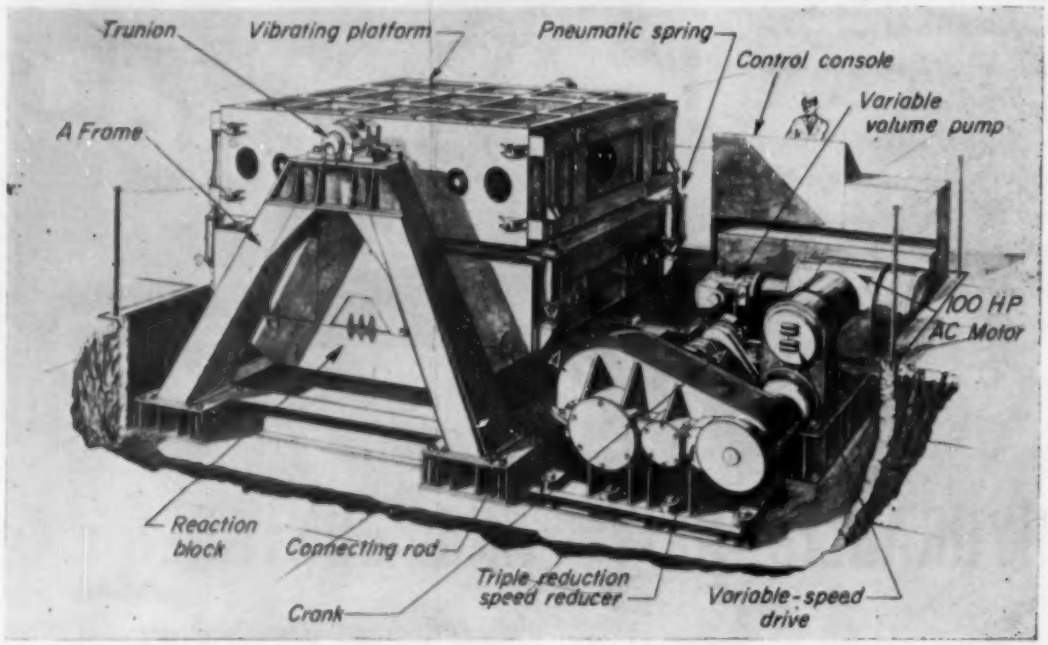
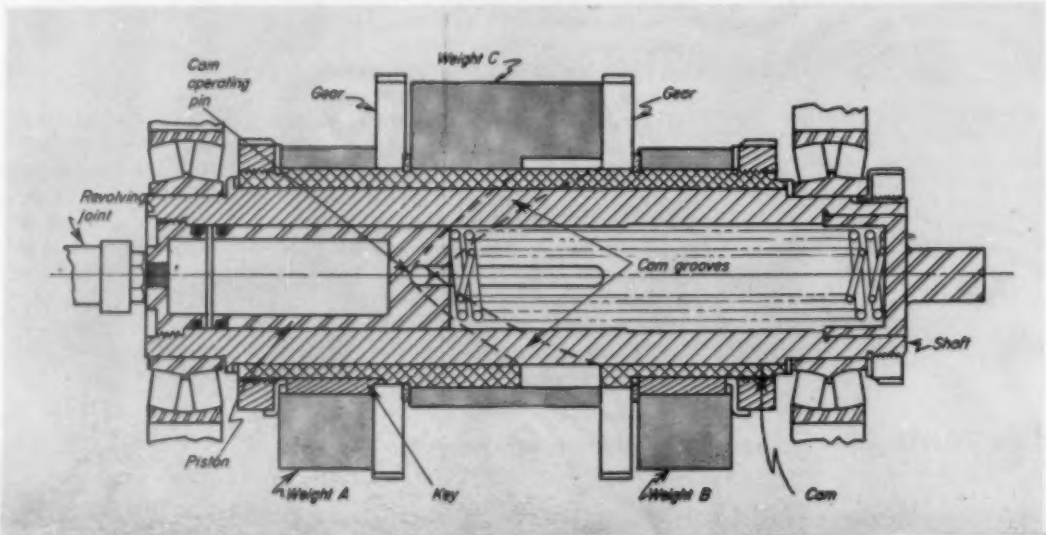


Fig. 1. The newly designed slosh testing machine described in this article consists of a large reaction block mounted on a frame by two trunnions. A vibrating table is mounted atop the reaction blocks on pneumatic cylinders. The sloshing motion is imparted to reaction block and vibrating table by a crank and connecting rod driven by an electric motor and speed reducer mounted at the right of the machine. Hydraulic pump, oil reservoir and pump drive motor are mounted in the pit.

Fig. 2. Vibration is generated by unbalanced-mass generators. Weights on two shafts which are geared together produce centrifugal forces which are additive in a plane normal to the axes of rotation and cancel each other in a direction parallel to the plane passing through the axes of rotation. Frequency of vibration of such a force generator is a function of speed of rotation and can only be varied by varying this speed. Vibration amplitude is a function of the unbalanced mass and the distance of this mass from the center of rotation. In these force generators a small hydraulic piston is used to vary vibration amplitude while in operation by varying the amount of unbalance of the lower shaft. This is done by shifting two of three eccentric weights with a pin and two groove cams driven by the pin. When no pressure is applied to the piston, it is spring returned and the shaft is both statically and dynamically balanced. Application of pressure causes the two moving weights, A and B, to move around the shaft toward the fixed weight, C, and thus create unbalance and vibration.



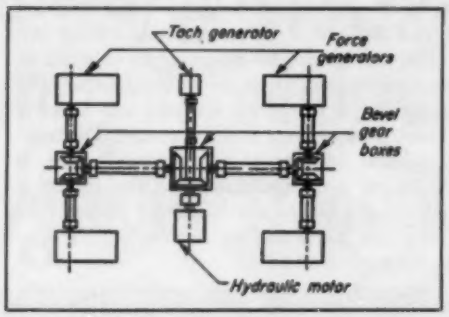


Fig. 3. Vibration generator drive arrangement.

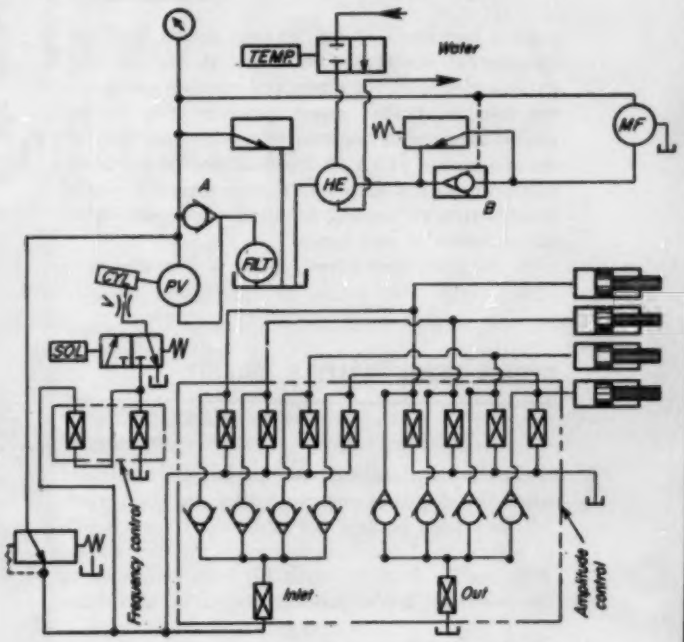


Fig. 4. Circuit diagram of the vibration generator shows frequency control and amplitude control circuits. With the solenoid valve energized, two needle valves are used to control pump displacement and thus motor speed and vibration frequency. To increase frequency the left-hand needle valve in the circuit is opened until the pump yoke positioning cylinder reaches the desired position. When this position is reached the valve is closed to maintain this frequency. To reduce frequency, the right-hand needle valve is opened to permit the cylinder to be spring returned to the desired position. The solenoid valve between the needle valve and the pump-positioning cylinder is part of the emergency-stop system. When de-energized, the valve connects the pump-positioning cylinder to tank which automatically assures minimum pump delivery. Emergency stop procedure initiated by de-energization of this valve also applies full reverse torque for braking. This occurs because the motor is driven by the load and functions as a pump. Negative pressure in the motor inlet line then closes pilot operated check valve *B* and the motor draws oil from the tank through check valve *A* and forces it to discharge the oil through the relief valve in the motor discharge line paralleling relief vave *B* which is set at full operating pressure.

Amplitude control is supplied by inlet and outlet needle valves which control position of the amplitude control cylinders in the vibration generator shafts. The four needle valves in series with the inlet and outlet valves permit individual cylinder adjustment to compensate for varying spring constants and friction in the individual cylinders.

deg. Slosh frequencies are from 10 to 20 cycles per minute.

Basically, the machine, Figure 1, consists of a large mass, or reaction block, mounted on trunnions supported by two A frames. Sloshing is induced by rocking the reaction block with a connecting rod and crank, driven by a 20 hp variable-speed drive through a speed reducer.

Mounted on the reaction block is the vibrating platform. Since the platform must vibrate as well as slosh, it is mounted to the block by air cylinders which function as springs. Motion is confined to the direction normal to the reaction block by guide rods.

Sinusoidal vibration of the platform is induced by four hydraulically controlled vibration generators of the unbalanced mass type, Figure 2. The four generators are rigidly mounted to the vibrating platform and are driven by a single hydraulic motor connected to the force generator by gear boxes and shafting, Figure 3. Any relative motion of the force generators and other drive components

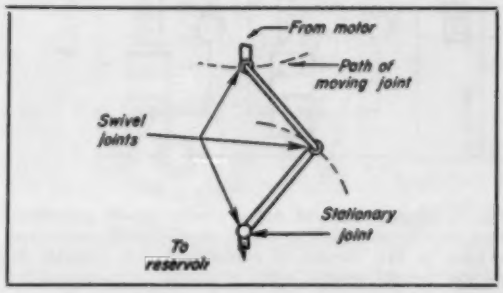


Fig. 5. Return line from the vibration generator drive motor has a dog-leg section to allow for table motion.

is taken care of by flexible couplings in the drive shafting. Correct phasing of the force generators is inherent since they are driven by a single motor.

An 80 hp variable-speed hydraulic transmission was chosen for the vibration generator drive be-

Concluded on next page

cause it best fitted all design requirements. A circuit diagram of the system is shown in Figure 4. A variable-displacement pump and constant-speed motor provide stepless speed variation over the required range with constant torque output. The hydraulic motor which is mounted on the vibrating platform has low mass and does not require special construction or housing to avoid the possibility of an explosion of fuel fumes.

A 34 gpm, piston-type pump is mounted in a pit just below the control console of the machine on the end bell of a constant-speed, 100-hp a-c motor. The 150 gallon oil reservoir is adjacent to the motor and pump. High pressure line from the pump runs up one leg of the A frame into a swivel joint mounted on the end of the trunnion. The trunnion is tubular and serves as a hydraulic line in addition to its structural function. The motor is mounted directly below the trunnion. Return line from the motor has a dog leg section, Figure 5, to provide for table motion. ▼▼▼

Since writing this article, Mr. Hutchinson has joined Wylie Mfg. Corp., El Segundo, Calif. as chief engineer.

SERIES SYNCHRONIZING CIRCUIT

AVIATION

Concluded from page 109

latches are hydraulically or mechanically released when the circuit is energized after an idle period. All lines must be kept full while the circuit is idle to assure good synchronization on the first stroke. This can be done by small fill lines connected to the reservoir, a low pressure source or an accumulator. These fill lines are cut into the system when the latches are engaged and blocked when the latches are released.

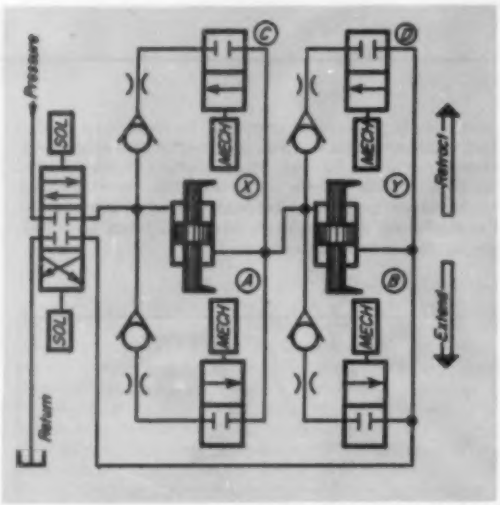


Fig. 3. Registration of series synchronized cylinders may also be accomplished with mechanically actuated valves. In this circuit, if cylinder *X* led cylinder *Y* on the extend stroke, valve *A* would be actuated to bypass fluid around cylinder *X* to cylinder *Y* and allow it to complete its stroke. Check valves in this circuit make the bypass one directional so cylinder positions can shift only at the end of the stroke.

If cylinder *Y* had led cylinder *X*, bypass valve *B* would have opened to permit fluid from cylinder *X* to pass to tank so that *X* could complete its stroke. Valves *C* and *D* perform in similar fashion on the retract stroke. Again orifices are in series with the bypass valves to hold pressure on the cylinder which has completed its stroke. This circuit could, of course, be constructed using limit switches and solenoid valves instead of the mechanically-operated valves.

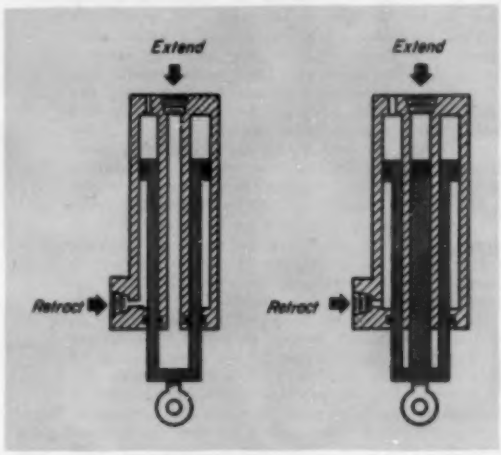
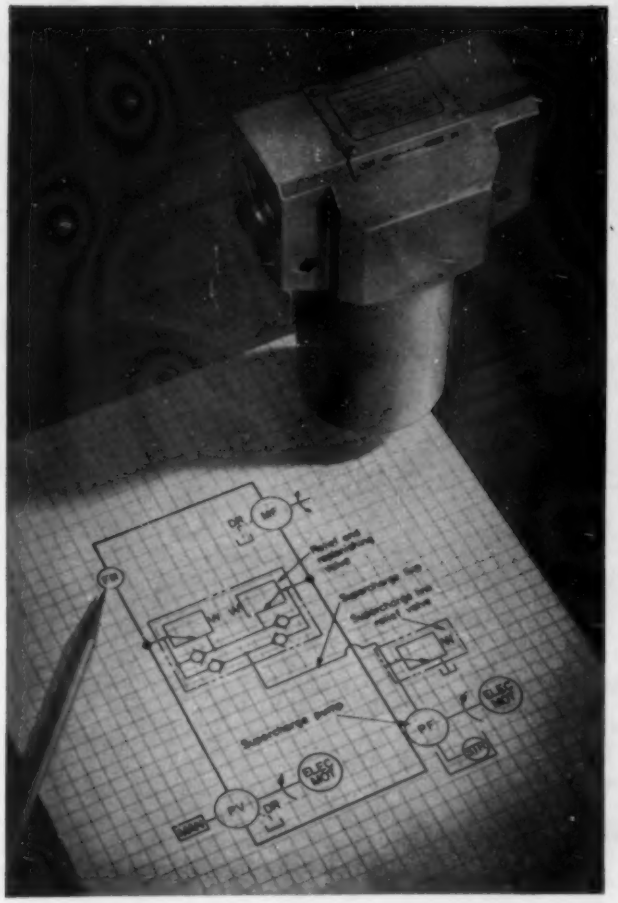


Fig. 4. Special folded cylinders having equal area characteristics of double-ended cylinders without the length requirement were constructed for use in the missile launcher application. Cylinders of this type could be used in any application where these characteristics are required.

This system for maintaining alignment when idle is more conveniently used with the bypass registration system discussed than with the limit switch system. With the bypass system, the circuit is continous in the fully retracted position and only one fill line is needed. With the limit switch system, separate lines are required for each portion of the circuit. An alternate method for keeping lines full is to use an open-center control valve with the latches.

There is no convenient remedy for the effects of fluid compressibility on the operation of a series synchronizing circuit. However, for most hydraulic fluids, compressibility is about 1% at 3000 psi and since pressure in the portion of the circuit between the cylinders will be 1500 psi or less in most applications, compressibility is rarely a problem. ▼▼▼

Filters put performance into this adjustable-speed hydraulic transmission circuit



For applications requiring any combination of torque and horsepower characteristics, an adjustable-speed hydraulic transmission consisting of a variable-delivery pump and variable-displacement fluid motor is generally used. In a reversing adjustable-speed hydraulic transmission circuit, either pump line may be the intake side. This type of transmission can be used to advantage in applications requiring a wide speed range. Over-all efficiency for this type of hydraulic transmission is approximately 85 per cent for all output speeds greater than 30 per cent of maximum.

In development of variable-speed transmission circuits, the rules and factors governing the design of hydraulic circuits in general apply. Protection of hydraulic fluid from contamination is essential for dependable performance of the circuit. And Purolator filters provide the most effective protection available today. The unit shown (PR-412-8) is used in many circuits like that above. It is part of a series offering a range in nominal rated capacity from ½ to 12 gallons per minute. The case can be unscrewed and removed for replacement of the element without disturbance to connections. To improve your hydraulic system, get precisely the filter you need by contacting Purolator.

THIS CIRCUIT incorporates a supercharge pump and a reversible replenishing system. Supercharging increases capacity of the main pump by maintaining pressure at the pump inlet and removing the possibility of cavitation at high flow rates. The supercharge pump has its own relief valve which limits inlet pressure to the main pump to approximately 150 psi. The relief and replenishing valve is a single unit which because of the arrangement of the check valves admits fluid to the system on the low-pressure side of the main pump but does not permit fluid pressure to be lost from the high-pressure side despite flow reversal.

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5000 psi is available with a reduced safety factor. Three-braid hose has some possibilities but lacks in flexibility.

Are hydraulic presses competing with mechanical presses?

In answering this question, Stan Durbin stated that the two types of presses are usually not in competition. The number of strokes per minute is usually not the deciding factor. One outstanding difference is that the hydraulic press produces full tonnage for its full stroke; the mechanical press starts producing full tonnage just above the work. Ability to stall, uniform work density as set by pressure, and more flexibility in tooling are advantages of hydraulic machines.

Stuart Keyser of Lake Erie Machinery reported a 300-ton press performing 22 strokes per minute on a 2 to 3-inch draw for auto hubcaps. Ted Novak of Danly Machine Specialties mentioned a press of 800 to 1200 tons having a 13-inch stroke operating at 18 to 20 strokes per minute. Safety devices on this machine prevent cocking of the slide or damage to the die. Otto Maha indicated that lower tonnage, hydraulic presses are being introduced for such operations as die casting trimming. Allan Steel mentioned small 4-ton presses performing 800, ⅜-inch strokes per minute with servo control.

Are valve passage areas necessary to compute pressure drops?

The flow path through a valve is so irregular and the areas are so variable that pressure drops are difficult to figure. This was the statement of Fred Gieryn of Vickers who added that pressure drop could best be determined from test and that such information is available. What is needed most are test standards. Design control of pressure drop is limited, and envelope dimensions are a big factor.

Is there an answer to objectionable pressure drop through sequence valves in a low pressure, die-closing circuit?

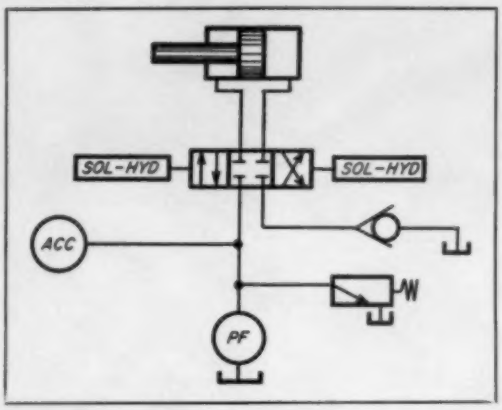
Sequence valves are available in 1¼ and 1½-inch sizes for flows of 45 and 65 gpm. The only difference between the two models is a larger pipe tap size. If you want to put more than the rated flow through a valve, expect the pressure drop to increase as the square of the flow. The 45-gpm valve has a pressure drop of 15 psi; the 65-gpm valve has a drop of 28 psi.

How can you reduce shock when shifting 4-way valves?

Biggest causes of shock are uncontrolled acceleration of the work and improper decompression. Bob Shartle of Vickers outlined several valves with controlled chokes in the pilot section for movement of the main spool. Ed Schmidt of DuPont explained the use of pilot valves to reduce shifting time where the pump is located at distances of 150 to 200 ft. and shock is a difficult problem. Using pilot pressure from the relief valve to shift the 4-way was a method advanced by Allan Steel, who also questioned whether increasing the line size was a solution.

Moderator Russ Hemeon suggested the use of hose with a bursting pressure near the shock pressure, so that the hose would take the bumps instead of the less flexible components. Hemeon also suggested the use of a check valve with a 35 to 40-lb spring in accumulator circuits.

In the circuit shown, when the valve is shifted to neutral, from the position in which the cylinder is extended, the exhaust fluid is moving so fast from the cylinder that a partial void is created in the line from the rod end of the cylinder to the valve. When the valve is shifted to retract the cylinder, this void must be filled first. The check valve helps prevent this void.



CHECK VALVE helps eliminate void created in cylinder rod-end line.

Shock depends on the rate the fluid is stopped. Frank Mackin described tests which showed that when fluid with a velocity of 15 ft/sec was stopped at the rate of 1800 ft/sec/sec, there was a 1000 psi/sec pressure rise and the normal pressure of 3000 to 4000 psi rose to a 6000-psi maximum.

What's being done to decrease shock of solenoid operation?

Probably the most important development is the oil-immersed solenoid now being applied to valves. The oil acts as a dashpot. No impregnation is necessary and the unit runs cooler. Manual operation is still possible and the installation permits elimination of pressure build-up in the solenoid. Conversion kits are available to modify existing solenoid valves for use with oil-immersed solenoids.

Continued on page 118

Circle 117

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What are the developments in air-operated valves?

Although there are advantages, demand for these valves seems limited and little development work is being done. John Hull of Hull-Standard mentioned that a 1⅛-inch air cylinder is available for installation on valves.

What valves are available for water systems?

Contrary to most thinking that only poppet valves can be used for water service, Allan Steel indicated the use of spool valves for de-scaling at 3000 psi and for hydrostatic testing. The air-operated, solenoid-controlled valves have been in service for 10 to 12 years with no wire drawing. Jess Williams of Great Lakes Steel also indicated the use of similar valves for de-scaling at 1000 psi. By changing the bronze parts to steel, these same valves are used for oil service.

What are the advantages of central hydraulic systems?

Interest in these systems is being revived. Frank Mackin outlined a transfer line using fire-resistant fluid and powered by a central system. He pointed out the disadvantage of inflexibility in plant layout.

THREE TECHNICAL PAPERS describing recent developments in automatic foundry machines, stretch-forming presses, and welding machines were given. Speakers shown (l. to r.) are John Lasater, Combustion Engineering; keynoter W. T. Cruse, Society of the Plastic Industry; Carl Blanchard, Sheridan-Grey; and Hans H. Hansen, Taylor-Winfield.

Several typical central systems were described with considerable interest shown in the use of standby pumps, accumulators, maintenance requirements, and system pressures.

What is the effect of viscosity in controlling fluid flow?

Viscosity can be a factor where feeds are critical. To overcome the effects of viscosity changes, a new temperature compensated valve has been developed. This has an orifice of expandable material, so that the orifice size changes with temperature to maintain constant flow. The valve is rated at 2000 psi, but can be used at 3000 psi in a meter out or bleed off circuit. Its use at 3000 psi in a meter-in circuit can cause trouble, but there is not a great requirement for this service. The valve has been tested for 500 hr at 1000 psi and 500 hr at 2000 psi with no wear on the orifice.

Is there a flow control valve which permits preselecting flows?

Suggested methods for preselecting flows were the use of cylinders rack-mounted on the valve, and connecting two or three flow-control valves in parallel and selecting one by actuating solenoid valves.

What is the transient time for a ⅜-inch pressure reducing valve operating on a supply pressure of 500 psi and controlling output at 150 psi?

Oscillographs were presented to show that operating time ranged from .03 to .04 sec. There was no change in performance when a water-base, fire-resistant fluid with a viscosity of 200 SSU replaced a petroleum-base fluid with viscosity of 225 SSU.

What are the factors in the service life of a large size variable volume pump?

Pressure, delivery, and duty cycle are important factors. For any specific application, the service life can be estimated by taking these factors into account. Mounting the pump vertically can have an effect. If the pump housing is maintained full of oil there should be no reduction in service life, but with the shaft mounted up, there could be some loss of pressure.

Is it advisable to pass cooling oil through the case of a piston pump?

Volumetric efficiency of these pumps is high and the internal leakage is not always sufficient for cooling. Therefore, explained Lou Jordan, it *is* advisable to use cooling oil. Charles Aaron of Cameron Machine reported some failure of shaft seals on variable displacement motors when cooling was used. This was caused by a pressure build up which is especially troublesome when cooling oil is passed over units in series. Pressure should not be over 10 to 15 psi and a spring-loaded check should be connected to provide a relief. Whether the oil is piped into the top or the bottom of the pump makes little difference in cooling.

What can be done to reduce oxidation of hydraulic oil?

Factors in the service life of oil are; air, moisture, temperature, contaminants, and equipment construction. Contamination was cited by A. S. Morrow of Shell Oil as the biggest problem. He mentioned the recent APPLIED HYDRAULICS article *Effect of Sludge on Hydraulic Oil* which indicated that as little as 1% contamination from old oil can greatly

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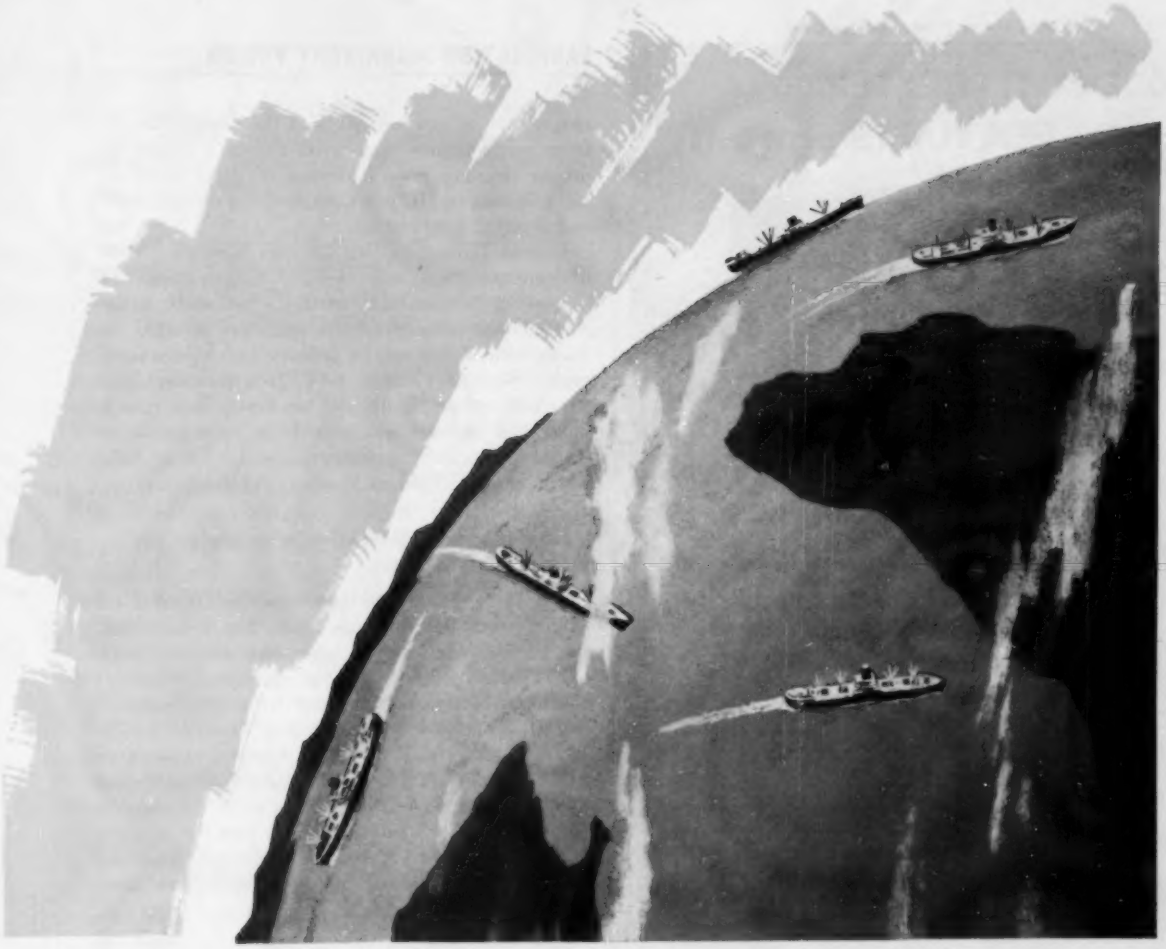

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reduce life of new oil. 90% of the complaints are from contaminants. Improved life is a matter of proper cleaning, good maintenance, using premium oil, adhering to JIC practices, keeping the oil clean, and limiting temperature.

Harold Tiffany of Sun Oil also cited the effects of contamination and elevated temperatures. In discussing compatability of fluids and seals, he indicated that some synthetic seals are affected by fluids with high viscosity indexes and high aniline points. Shrinkage can be 10%. To a question about standardization of oils, he answered that closely controlled oils are available from most manufacturers. Seals are the controversial subject and are not as standardized as fluids.

How can you determine whether to use fire-resistant fluid?

Some of the hazard factors listed by Dr. William Millett were the presence of molten metal, open flames, or other high temperature sources; leakage; and movable hydraulic equipment. Some of the hazards may be overcome by safety engineering. He mentioned one instance in which oil squirted 40 ft. starting a fire in which 3 men were killed. Under certain conditions of pressure and rupture, a distance of 80 ft. is possible. Monsanto's M. C. Plummer said that Alcoa has set a 45-ft. limit for systems operating at 1000 psi. The idea of simply barricading hydraulic machines from hazards was advanced by Ed Schmidt of DuPont.

Are the emulsion type fire resistant fluids being used successfully?

Field reports have indicated satisfactory use of these fluids. Don Fornell of Vickers said that some noise is evident in larger pumps of 14 and 36 gpm because of the high viscosity and specific gravity of these fluids. This can be eliminated by improving the pump inlet conditions and making some modifications to the pump.

Are there paints available for use with fire-resistant fluids?

Several types were mentioned. Proper cure after painting is important. One type requires 100 hours for curing. Whether to paint before or after fabrication of the reservoir is a problem. Russ Hemeon pointed out that painting before can cause an awful odor when the welders go to work. Extension guns are available for painting after fabrication. An entirely different solution was proposed by Ed Schmidt of DuPont who is building tanks of stainless steel.

How do synthetic fluids affect the life of hydraulic pumps? Reports are encouraging, said Don Fornell. Some of the synthetic fluids give as good or better life compared to petroleum fluids. Cavitation can be a problem. Maintaining a clean system is especially important.

What are the important maintenance factors and how can personnel be trained?

George Altland of Vickers stressed proper enclosure of the reservoir, use of high quality fluid, and keeping the equipment and fluid clean. In-plant training is important.

Should solenoid-pilot valves be dismantled periodically for inspection?

Periodic checks are desirable, but sometimes it is better to leave well enough alone, explained Ed Guiliani of Vickers. Replacing the entire valve in case of failure is a common practice. The use of aircraft type electrical connectors was explained by John Lasater of Combustion Engineering.

Are standard magnetic plugs or filters available?

Three suppliers were mentioned as well as reference to the article in March '57 APPLIED HYDRAULICS by Russ Hemeon describing the use of magnetic plugs.

Hemeon stressed that designers must locate filters and plugs near an opening to aid maintenance. Full flow filters for pressure and return lines are being developed. These will be mostly for mobile equipment applications. They will include a bypass check valve and some means to indicate when they should be changed.

What are the developments in industrial servo valves?

Ron Render of Vickers described an industrial electro-hydraulic servo valve of the two-stage, sliding spool design. This is less sensitive to sticking and has a frequency response high enough for industrial applications. Electrohydraulic servo valves have the advantage over mechanical valves of fitting in with the coming numerically controlled machines.

Are there satisfactory packings for use with synthetic fluids?

Houghton's Harold Blair explained that it is difficult to make a good all-around packing. Good packings for fire-resistant fluids are available but they react poorly when there is a slight contamination of mineral oil. 2% mineral oil contamination can increase swelling 40% in 168 hr. Suitable packings are available for all fluids if the necessary information is given, explained Tom Beiterman of Precision Rubber.

Problems of the machine manufacturer were brought out by Stuart Keyser. Frequently the customer doesn't decide until late in the design which fluid he wants. R. A. Jacobson of Kux Machine has the customer buy the fluid or buys it for him. The machine is flushed with the fluid full strength or diluted then filled and tested.

In the works is a fluid with a preservative so that the machine can be tested, drained, and shipped.

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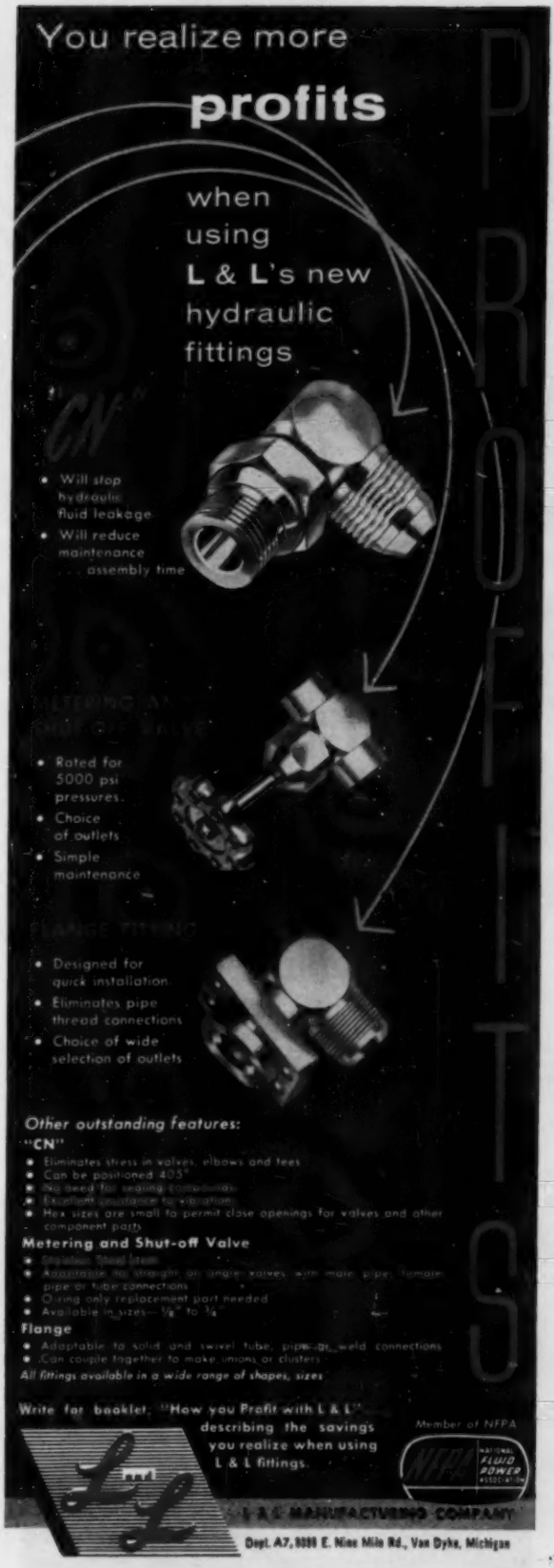
You realize more
profits
when using L & L's new hydraulic fittings
PROFITS
"CN"
• Will stop hydraulic fluid leakage
• Will reduce maintenance . . . assembly time
• Rated for 5000 psi pressures.
• Choice of outlets
• Simple maintenance
• Designed for quick installation
• Eliminates pipe thread connections
• Choice of wide selection of outlets
Other outstanding features:
"CN"
• Eliminates stress in valves, elbows and tees
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Metering and Shut-off Valve
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Flange
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All fittings available in a wide range of shapes, sizes
Write for booklet, "How you Profit with L & L" describing the savings you realize when using L & L fittings.
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NATIONAL FLUID POWER ASSOCIATION
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Circle 78 on Reader Service Card

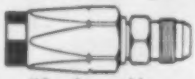
Circle 68 on Reader Service Card

LEAK-PROOF!

REQUIRE NO SPECIAL ASSEMBLY TOOLS

NEW HYDRALINK MALE SWIVEL REUSABLE COUPLING

Male reusable—Rigid



JIC male reusable

JIC female reusable—Swivel

90° Swivel elbow

Permanent coupling assemblies

Hydralink couplings, both permanent and reusable types, are quality units conforming design-wise with national and JIC standards but going a step farther in providing simplified installation and positive leak-proof seals that exceed the demands of peak pressure loads. The new Hydralink catalog is easy to read and helps you select the units you want without cross reference and guessing. Write for it today.

Several territories still available.

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Hazel Park, Mich.

SAFEGUARD YOUR GAGES WITH REPUBLIC PROTECTORS

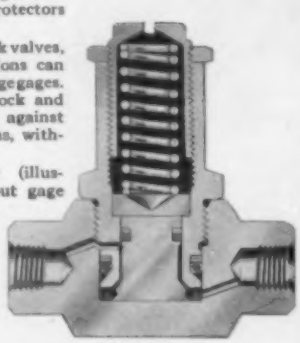
PROTECT your expensive gages from damage with Republic Gage Protectors and Pressure Snubbers.

Fluid hammer, chattering check valves, and severe pressure fluctuations can cause extreme shock, and damage gages. Pressure Snubbers absorb shock and permanently protect gages against damage from wild fluctuations, without affecting accuracy.

Adjustable Gage Protector (illustrated) automatically cuts out gage when system pressure rises above gage range, and reopens when pressure drops.

Two types—ranges 15 to 5000 psi; 3 to 50 psi.

Working pressures to 10,000 psi.



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RM REPUBLIC MANUFACTURING CO.

15655 BROOKPARK ROAD • CLEVELAND 11, OHIO

FABRICATING MACHINERY FORUM

The poly-sulfide impregnated leathers are good for all fluids and are fabricated in V-rings, cups, O-rings, and flanges. Temperature has a big effect on their performance and at 160 to 180F you can expect trouble.

What are the recent developments to eliminate leakage at pipe joints?

A new seal retainer was revealed by Bob Erskine. It's designed to eliminate the effects of deflection and permit sub-plate mounting larger valves. Erskine expressed disappointment in the acceptance of straight threads on industrial equipment. Stocking can be a problem as brought out by Bob Lindsey of Hydraulic Press who indicated his preference for straight-thread fittings.

Speaking plainly about the problem of tapered threads, Jim Robinson said, "The only thing you can do is face it and get rid of the junk." He indicated that all equipment can be furnished with straight threads.

However, tapered threads will be around for a long while, and there are methods to improve their performance. One of these is a lock washer with Teflon insert which is being used successfully. Both original equipment builders and users report good experience with this product. ▼▼▼

FLUID POWER FOR BENDING

Concluded from page 73

tinuously—either directly back to tank between operations, or to the operating cylinder as directed by the valve porting.

Aircraft bends are often very critical, and special benders with special hydraulics are frequently needed. Air duct tubing, hydraulic tubes, oxygen lines, de-icer connections and other components must be as thin, light, and compact as possible. Very little space is available, so bends are often very close together.

For such service, further separation and control of the various hydraulic circuit elements is desirable. Loading stresses are high to control tube form for critical radii or thin walls. The inside bend areas are under coining pressures while the outer sections are being drawn and stretched as far as metallurgical quality permits. Hydraulic cylinders are extra large, actuated individually, and mounted with maximum rigidity. Any significant deflection of the cylinder supports, the frame, or any of the tooling will deform the tube.

Pressure die actuation for these purposes is best controlled in a separate hydraulic circuit individually adjusted to each tooling set-up. On one bender for aircraft work the wedge action advance of the pressure die mounting and its controlling pressure on the die is automatically maintained by its own pump, pressure control valve, and 4-way valve. ▼▼▼

AIR CONTROLS OIL CIRCUITS

Concluded from page 69

the 4-way EJECT valve controlling flow to the ejector cylinder. The ejector cylinder advances at 400 in./min. until the EJECT RETURN limit switch is actuated de-energizing the EJECT UP valve and actuating the EJECT DOWN valve. This directs flow from the right-hand pumps to return the ejector cylinder at 565 in./min. When the EJECT STOP limit switch is actuated, the EJECT DOWN and EJECT UP-DOWN valves are de-energized. Delivery from the right-hand pumps is again directed to the main cylinder and the ejector is locked in place.

When the platen reaches the top of its stroke, it actuates the TOP STROKE limit switch de-energizing the UP valve and stopping the press. Once the press has stopped, there is no hunting, because the pumps are completely by-passed, and the oil is locked in the cylinders by the HOLDING VALVE and the 4-way operating valve.

If the press is in automatic operation, the cycle is repeated until the STOP pushbutton is pressed. A jogging feature permits the operator to lower the platen at pressing speed and to raise it. The ejector cylinder can also be jogged for set-up purposes.

PREFILL VALVE DESIGN

The normally open prefill valves have a partially balanced design which provides a light sealing pressure. Together with the normally open design, this provides controlled opening and fast closing. This type of valve has been in service for years without maintenance on the seat for wire drawing or other reasons.

The normally open design also permits a wide open passage between the supply tank and the main cylinder of the press, except when pressure is being applied to the main cylinder. Thus the valve supplies a free flow into the main cylinder during the rapid advance stroke without the requirement for suction to open the valve. Cavitation is reduced to an absolute minimum, and low velocity flow through the valve is insured at all times. Pilot lines or cylinders are not required to open the valves on the upstroke of the press. During the idle periods of the press, the normally open valves allow any air which may be entrained in the oil to rise out of the main cylinder and pass into the tank.

SAFETY FEATURES

When the reversal is controlled by the BOTTOM STOP limit switch, the point of reversal for any given setting of the control dogs is held to close limits depending on the speed of the press. As a safety measure the SLIDE RETURN pressure switch may be set slightly above the normal working pressure to reverse the press if abnormal pressures are developed.

When the reversal is controlled by pressure, the pressure switch is adjustable over at least a 10:1 range. As a safety measure, the position reverse may be set to protect the dies from damage in case of operation without work in the press. ▼▼▼

IT'S NEW

BECKETT Hi-Cyclic

AIR TIME DELAY VALVE

Solenoid-operated
Air Time Delay Valve

Hand-actuated
Air Time Delay Valve

- Adjustable delay time to 30 seconds. Accurate repetition.
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- Sizes ⅛" through 1" NPT ports.
- Standard or manifold mounting.
- Time delay unit for hand-actuated valve can be supplied in kit form for remote mounting.
- Exhaust controls optional for air models.

. . . For any directional Control Valve Requirement

first check it with Beckett!

✔ A complete line of advanced-design air and hydraulic control valves. More than 150 models—solenoid, manifold, piloted, solenoid piloted, lever, cam roller, spring center, detent and combinations of these actuators.

✔ All spool types: 2 position, 3 position, float piston, open center, closed center, servo, port exhausting center position.

✔ All carried in stock for immediate delivery. Write for complete valve catalog or detailed information on Hi-Cyclic Valves to meet your specific requirements.

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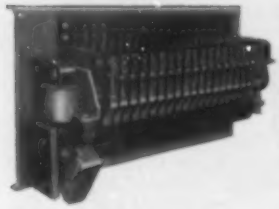
THE BECKETT-HARCUM COMPANY

1086 WAYNE ROAD, WILMINGTON, OHIO

NEW EAGLE STEP SWITCH SIMPLIFIES CIRCUIT SEQUENCING

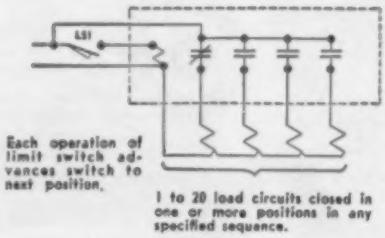
. . . for machine tools, presses, conveyors, processes



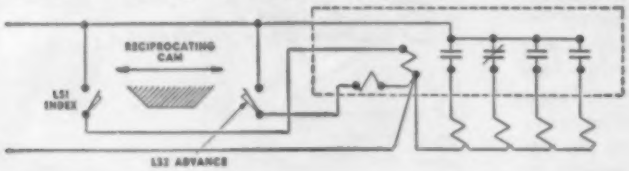
These 3 basic ideas are yours

for simplified interlocking or sequencing of multiple load circuits. Any and all three will eliminate many other electrical components, and cut your initial cost.

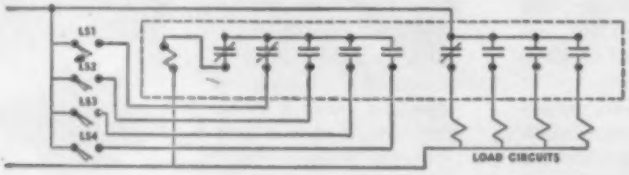
Operating load circuits in sequence:
A limit switch on a machine or indexing device closes and opens upon each operation to advance the Eagle step switch. Or a timer may be used to operate each load circuit for a predetermined time.


LS1
Each operation of limit switch advances switch to next position.
1 to 20 load circuits closed in one or more positions in any specified sequence.

Interlock sequence: *Two limit switches* are operated alternately. This provides a safety feature. It insures that the movement of the machine has been completed before the Eagle step switch advances.



Interlock sequence with several limit switches: Each limit switch advances the Eagle step switch one position. Switches must operate in sequence or the step switch won't advance.



Send for new Eagle Bulletin 850. Simply write to Eagle Signal Corporation, Industrial Timers Division, Moline, Illinois, Dept. AH-757.

New Products / continued

LEAD SHIELDED FILTER
. . . for radiation protection

Features: The filter provides microscopic clarity of atomic energy liquids without danger from harmful radiation. Four feet high, this

special filter with honeycomb filter tubes weighs over five tons. Extreme weight is due to a four-inch thick void-free lead shield surrounding the entire filtering chamber and cover. The integrated shield protects workers by absorbing injurious radiations. It permits the container to be decontaminated and used indefinitely.

Commercial Filters Corp.
Melrose, Mass.

Circle 163 on Reader Service Card

BACK-UP RINGS
. . . made from Teflon

Designation: S-11248 & SR-2619
Features: Rings are solid split type made of Teflon, easy to install in

internal and external applications. They protect and extend endurance and improve performance of O-rings at high temperatures and in fluids having adverse effects on O-rings and other back-up materials. Rings are assembled on precision mandrels to maintain accurate cir-

cumference and shipped in telescopic metal end mailing tubes. Military Standards assigned are: MX-28774 equivalent to S-11248; MX-9058 is SR-2619.

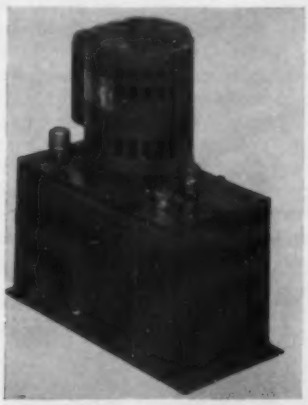
W. S. Shamban & Co.
Culver City, Calif.

Circle 164 on Reader Service Card

HYDRAULIC POWER UNIT . . . has close-coupled pump

Designation: AC-4PK-1

Features: Design features close-coupled hydraulic pump and electric motor, with pump located in the reservoir to reduce outside plumbing. Close-coupled pump and motor unit reduces shaft misalignment. Gear type pump has needle bearings and optional integral re-



lief valve and check valve. Unit includes electric motor, adapter, pump, reservoir, filter, air breather and fittings for external plumbing. **Specifications:** Available in five sizes from .75 gpm to 4.5 gpm at 1750 rpm with pressures to 1750 psi. Reservoirs range from 2 to 10 gallons.

Spencer Hydraulic Equipment Co., Inc.
Racine, Wis.

Circle 165 on Reader Service Card

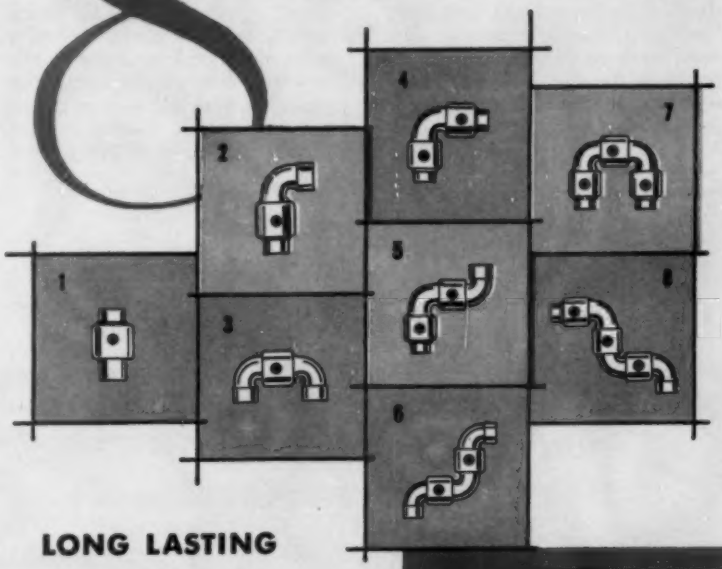
NEW THROTTLING VALVES . . . for precision control

Features: The valves offer low torque, precision control, high effi-

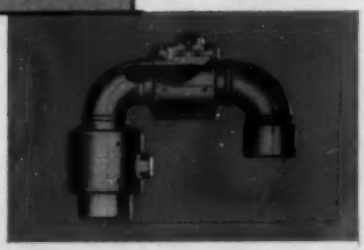
ciency and long life. They have self-aligning seats, a variety of port

Continued on next page

8 EIGHT BASIC STYLES
OVER 500 MODELS

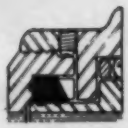


LONG LASTING
CONTINENTAL-EMSCO
SWIVEL JOINTS



Continental-Emsco Swivel Joints are manufactured in all popular sizes for practically every type of service; from high vacuum to pressures of 15,000 psi, and from sub-zero temperatures to 750°. You can service a Continental-Emsco Swivel Joint without removing it from the line. Just break the joint as you would a pipe union. Packing is then readily accessible and can be replaced when necessary. No expensive returns to factory for repair.

Call or write today for complete information.



Grooved packing for high temperatures or corrosive services.

Lip type packing for both high and low pressures.

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Serving the Oil and Gas Industries ... Worldwide

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A Division of The Youngstown Sheet and Tube Company
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Circle 32 on Reader Service Card

New Products continued

sizes with only two basic body configurations, and light weight. The valve body can be removed without breaking the line, and the valve seat can be replaced without removing the body from the line. They are available with female pipe thread, female brazed tube fitting and JIC threaded parts. The valve series is designed for use with oils, fuels and other liquids compatible with aluminum and steel in central hydraulic systems, missiles systems, aircraft and marine applications.

The valves use standard O ring seals; integral valve stem and poppet of hardened, ground and polished steel; with valve seat of hardened ballbearing steel.

Specifications: The valves are available with 2 in., 1½ in., 1¼ in., ported flanges adaptable to one basic body size; and 1 in., ¾, ½, ⅜ and ¼ in. ported flanges adaptable to another basic body size.

Greer Hydraulics, Inc.
Jamaica, N. Y.

Circle 166 on Reader Service Card

GOSHEN

TETRASEALS

a unique development in high-performance, economical seals for static applications by Goshen Rubber

RECTANGULAR-SECTION RINGS

If low friction plus dependable sealing at a wide ambient temperature range are your requirements, then TETRASEALS are for you . . . for static and in some cases, moving applications. TETRASEALS are interchangeable with standard O-Rings, use the same groove, and are non-laminated (in one homogeneous piece).

Edges are accurately formed, and cross-sectional tolerances can be held to ±.004 depending on inside and outside diameter, on size of cross-section and on material desired. Available in natural, synthetic, and silicone rubber compounds to meet MIL, AMS, SAE, ASTM and industrial specifications. To find out what TETRASEALS can do for you, ask for Technical Bulletin No. 11.

See our catalog in Sweet's Product Design File.

PUT Goshen Rubber TO WORK FOR YOU

GOSHEN RUBBER CO., INC., 1377 S. TENTH ST., GOSHEN, IND.

AIR VALVE

. . . exceeds JIC requirements

Features: The body and solenoid are completely independent units. Each can be removed separately from the base without disturbing the other. This eliminates confusion of responsibility between electrical repair and mechanical repair. It also simplifies maintenance and part replacement. The valve has an integral conduit box and an improved solenoid with new shock-resistant mountings. The air chamber, spool and engineering are identical to all other MAC valves.

Specifications: The new valve is available in ⅜ in. single-solenoid, double-solenoid, and 3-way models.

Mechanical Air Controls
Detroit, Mich.

Circle 167 on Reader Service Card

IN-LINE PRESSURE SWITCH

. . . withstands vibration

Features: Designed for hydraulic, fuel and pneumatic systems, this piston type pressure sensing unit performs accurately under fast, continuous operation. It is unaffected by jarring or vibration. A compression spring controls the point of actuation, and may be adjusted externally to accommodate minor changes.

Specifications: Standard units with ⅜ in. male tube size or ¼ in.

male pipe pressure connection and an AND type electrical connection are available from 100 to 3500 psi.

The valves weigh 3 oz., are 3 in. long, and will operate from —65 F to 165 F with an electrical rating of 15 amps at 120 v ac.

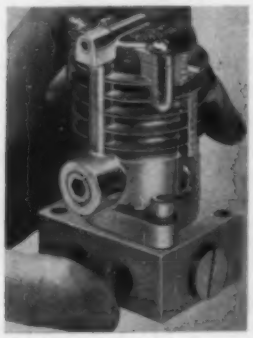
Fisher Controls Inc.
Santa Monica, Calif.

Circle 168 on Reader Service Card

FOUR-WAY VALVE
. . . weighs only 30 oz.

Designation: Bantam

Features: Valve is four-way type, single solenoid design, only four inches high and weighs only 30



ounces. Four-way action is achieved with a single solenoid pilot and a pressure-balanced shuttle in the valve body. Unit has only three working parts, has fast response and seals bubble-tight.

Specifications: Valve body is anodized aluminum and moving parts are stainless steel. Designed for two-point mounting, valves may be used with pressures from 15 to 140 psi. All ports are tapped ¼-in. NPT. Solenoid pilot has coils for ac or dc in any voltage. Optional features include manual override integral junction box.

Valvair Corp.
Akron, Ohio

Circle 169 on Reader Service Card

PRESSURE REGULATOR
. . . for pressures to 3500 psi

Designation: 2840100 pressure regulator

Features: The manually-operated

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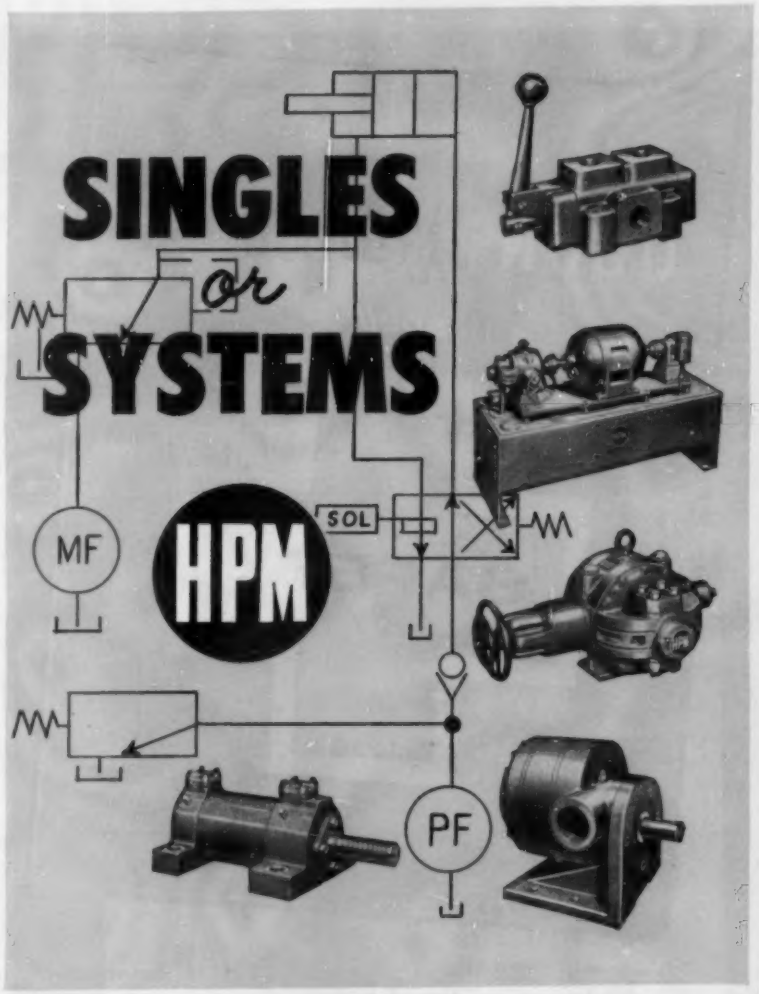

WHAT'S YOUR HYDRAULIC PROBLEM?

H-P-M's complete line of hydraulic components, PLUS a 77-year background of experience in the design and building of hydraulic equipment, can solve your hydraulic problems . . . whether it's a single item or a system. And you can transfer your worries for the job to one responsible supplier. The power and control of power needed, to get the motion you require, are designed to your specifications.

Plan hydraulically — get in touch with an H-P-M Engineer today. A complete line of standard hydraulic pumps, power units, valves, cylinders and accessories makes the job of selecting the right hydraulic component simpler, easier and at a savings. Ask for Bulletin 1101 today — a complete condensed catalog of H-P-M hydraulic equipment.

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HYDRAULIC POWER DIVISION

THE HYDRAULIC PRESS MFG. CO.

Mount Gilead, Ohio, U.S.A.

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Circle 70 on Reader Service Card

This new booklet . . .

. . . tells you how CARBIDE's UCON Brand hydrolubes spell safety for you, your plant, and your employees.

Yes, industrial experience over a period of more than 10 years has shown that the common fire hazards connected with hydraulic operations are eliminated when UCON hydrolubes are used. So, why not find out how the fire-resistance, outstanding anti-wear characteristics, and corrosion protection of new and improved UCON hydrolube "CP"-type fluids can help spell safety for you. Write for "Ucon Hydrolubes Spell Safety," Form 40134.

CARBIDE AND CHEMICALS

CARBIDE AND CARBON CHEMICALS COMPANY

A Division of Union Carbide and Carbon Corporation

30 East 42nd Street, New York 17, New York

"Ucon" is a registered trade-mark of Union Carbide.

New Products / continued

pressure regulator is for use in labs or in conjunction with portable or stationary air compressors. It is of the spring-loaded, balanced-pressure type and incorporates an integral relief feature which permits upward or downward adjustment of delivery pressure without separate relief of the delivery pressure line.

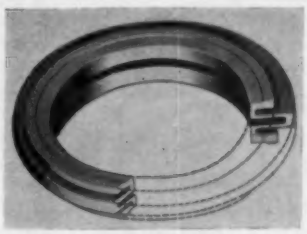
Specifications: With 3000 psi inlet pressure, pressure drop is less than 200 psi when flowing 15 scfm. Flows up to 100 cfm are obtainable with corresponding increase in pressure drop.

Cornelius Company
Minneapolis, Minnesota

Circle 170 on Reader Service Card

STATIC SPRING SEAL . . . for temperature extremes

Features: Made of Inconel-X and other ultra modern materials, it covers a temperature range from —320 F to 2000 F. Made in regular sizes of ½-inch to 10-in., and to 33-in. on special order, this seal was designed



to solve aircraft and missile fuel leakage problems. Other difficult to seal fluids in pneumatic and hydraulic systems have been contained using the new seal.

Skinner Seal Company
Santa Ana, Calif.

Circle 171 on Reader Service Card

Continued on page 130

ACCO
Helicoid Gage
U.S.A.

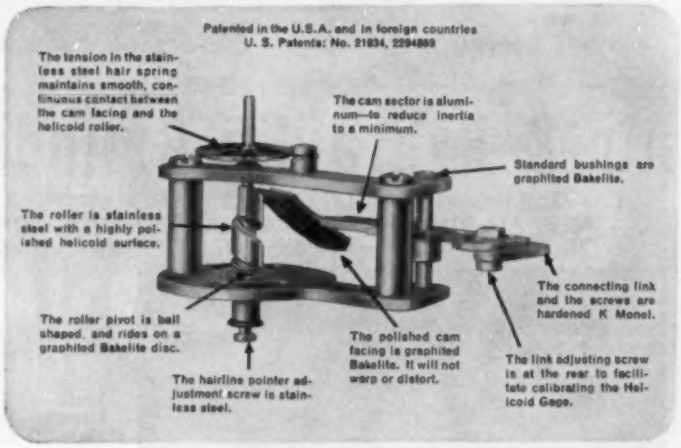
NOTHING BUT THE BEST IN GAGES FOR WORKING PRESSURES FROM 30" VACUUM TO 10,000 p. s. i.

These details of Helicoid gage design assure longer life and enduring accuracy

The superiority of Helicoid Gages is most evident in severe service—wherever a gage is subjected to violent pressure pulsations or severe mechanical vibrations.

The *sustained accuracy* of Helicoid Gages over *millions of cycles* is explained by the details of design and construction of the Helicoid movement shown at the right.

Rolling action of the cam facing against the roller surface . . . graphited Bakelite bushings, roller pivot base and cam facing . . . K Monel connecting links and screws . . . all such Helicoid features protect against wear and corrosion and assure sensitivity, sustained accuracy and trouble-free operation through millions of cycles.


Patented in the U.S.A. and in foreign countries
U. S. Patents: No. 21834, 2294895
The tension in the stainless steel hair spring maintains smooth, continuous contact between the cam facing and the helicoid roller.
The cam sector is aluminum—to reduce inertia to a minimum.
Standard bushings are graphited Bakelite.
The roller is stainless steel with a highly polished helicoid surface.
The connecting link and the screws are hardened K Monel.
The roller pivot is ball shaped, and rides on a graphited Bakelite disc.
The polished cam facing is graphited Bakelite. It will not warp or distort.
The link adjusting screw is at the rear to facilitate calibrating the Helicoid Gage.
The hairline pointer adjustment screw is stainless steel.

EASIEST ADJUSTMENT AND CALIBRATION

Only Helicoid Gages have the external pointer adjustment pictured here. The Helicoid type adjustment cannot be jarred out of position.

Calibration of Helicoid Gages is accomplished easily, without removing dial or pointer, because the link adjusting screw is at the rear of the system.

TUBES BUILT FOR MILLIONS OF PRESSURE PULSATIONS

To fit the wide range of applications, Helicoid Bourdon tubes are available in four materials—alloy steel, K Monel, stainless steel and phosphor bronze.

All Helicoid tubes are made from seamless tubing and are carefully designed to give maximum torque and minimum stress. When used within the dial range, they will withstand many millions of pressure pulsations and will not stretch, leak or crack.

HELICOID DIALS ARE EASIEST TO READ

Helicoid Gage Standard Dials are well known for quick and easy readability. Tests show that they are easily read at a greater distance than is ordinarily possible.

Dials are furnished jet black with white figure markings or dull white with black figure markings. Standard dials are of laminated phenol with a transparent plastic surface. They are non-corroding, will not discolor, fade, crack, chip or peel and can be cleaned without damage.

For complete information on the Helicoid line of gages write for **Catalog G-52**

Helicoid Gage Division
AMERICAN CHAIN & CABLE

929-H Connecticut Avenue • Bridgeport 2, Connecticut

ACCO TRADE MARK

Helicoid gives you all these features at prices that are competitive in the quality gage field

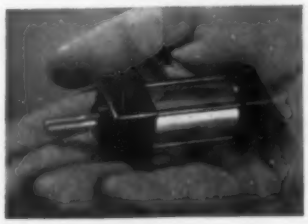
New Products continued

SMALL AIR CYLINDERS

. . . with square head design

Designation: Tiny Tim

Features: This 150-psi miniature cylinder is available in various mountings with both single and double-rod styles in ¾ in. and 1⅛ in. diameters. It uses steel heads, caps and mountings, high-tensile steel tie-rods, hard-chrome plated piston and piston rod, brass tube, bronze rod bushing, replaceable quad-ring packing and tapered tube seal. All steel parts have a black oxide finish.

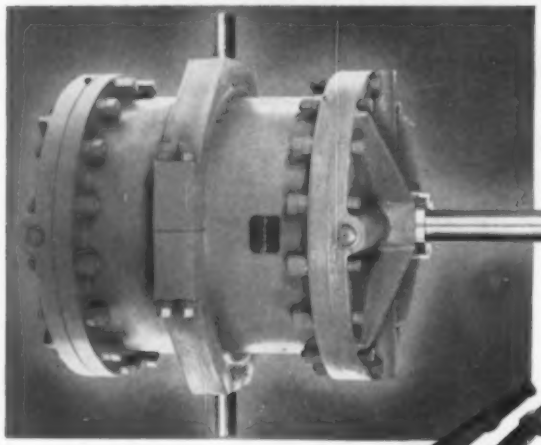


Compressed Air Service Co.
Dayton, Ohio

Circle 172 on Reader Service Card

Air & Hydraulic Cylinders

• FOR HEAVY-DUTY APPLICATIONS OF ALL TYPES • TO MEET ALL SIZE AND PRESSURE REQUIREMENTS • BORES TO 32" DIAMETER • STROKES OF 50 FT. AND LONGER.



Stroke—13½ Inches
Diameter—24 Inches
200 P.S.I. Air Pressure

Stroke: 34 Ft.
Diameter: 7 In.
1500 P.S.I.

Write today for Lincoln's catalog. It gives engineering data on many types and sizes of heavy-duty cylinders.

Lincoln Machine Company will design, engineer and build standard or special hydraulic and pneumatic cylinders with trunnion, rod-end flange, blank-end flange, foot, clevis or centerline mountings.

Call on Lincoln when you require large, powerful rotating or non-rotating hydraulic and air cylinders, heavy-duty mill-type cylinders. Our engineering department will give you fast, practical assistance in design problems . . . and our modern plant will build your cylinders quickly and economically.

LINCOLN MACHINE CO. INC.
P. O. BOX 272 • SALEM, OHIO

POWER BENDER

. . . for one shot bending

Designation: No. 884

Features: The lightweight hydraulic bender will make a 90 degree bend in 4-in., and smaller, conduit and pipe with one ram stroke. Through the use of aluminum alloy, one man can carry the heaviest section of this 40-ton bender. Especially designed pipe supports serve as rollers when wheeling bender from one location to another. It can be used in any position without loss of operating efficiency.

Specifications: Operated with the No. 798AC-SA power pump, and connected by a quick coupling high-pressure hose, the bender will bend 4-in. pipe 90 degrees in four minutes. Using power pump No. 797E-SA, it will do the bending in only 30 seconds.

Greenlee Tool Co.
Rockford, Ill.

Circle 173 on Reader Service Card

DUAL SWITCH

. . . controls pressures

Designation: Type J27KB

Features: This dual-switch differential-pressure control regulates the pressure differences between two pressures or vacuum sources. Each switch has a separate uncalibrated adjustment screw. The switches are actuated when the pressure on the high side exceeds the pressure on the low side by the pre-set amount, regardless of the static pressure value. Switches may be set together to simulate double-pole circuitry or set apart to obtain independent operation.

Specifications: Seven models are offered with system differentials to 90 psi. On-off switch differentials between the limits of 1 in. Hg. and 5 psi are obtainable. The assembly

is available with three standard switches: normally-open, normally-closed, or double-throw with no neutral position. Switches are rated up to 15 amps at 115 or 230 volts ac, dc. Twenty amp ac switches are also available. The bellows are brass, monel or stainless steel. Mounting ears are located on each end of the case.

United Electric Controls Company
Watertown, Mass.

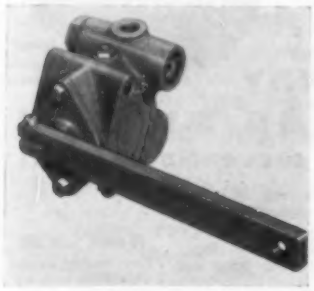
Circle 174 on Reader Service Card

AIR SUSPENSION VALVE

. . . has adjustable time delay

Designation: Levelator valves

Features: These air suspension system valves automatically maintain the most desirable axle-to-chassis height on trucks, buses and trailers. Large orifices provide rapid, accu-



rate corrections of changes in height, except for normal suspension motion caused by road irregularities. A time-delay device conserves vehicle air supply by actuating the valves only after a sustained change in height. This time delay is adjustable to the requirements of the load. The system conserves air in the reservoir during loading and unloading, when the compressor is not in operation. More air is available for braking.

Continued on next page

NO ONE FILTER MEETS ALL DESIGN NEEDS . . .

and Only CUNO offers you

5 DISTINCT TYPES OF FILTER MEDIA

♦ EDGE-TYPE ♦ WIRE-WOUND ♦ SCREEN
♦ FIBER CARTRIDGE
♦ POROUS METAL

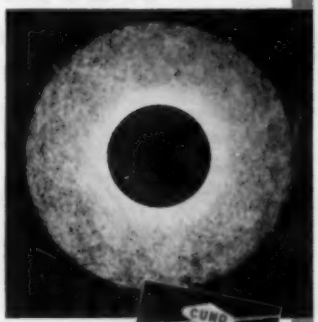
THE New WHITE CELLULOSE MICRO-KLEAN® FILTER CARTRIDGE

Where Filter Design Calls For —

5-MICRON FILTRATION . . . removes *all* particles down to this size *and* a large percentage of particles down to 1 micron or smaller.

COMPLETE SANITATION . . . for water, liquid food processing and other applications where *clarity, purity* and complete absence of any filter-imparted *taste* are essential.

EXCLUSIVE "GRADED DENSITY" construction makes entire depth of cartridge body available for micronic filtration . . . *doubles* cartridge life, cuts replacement costs *in half!*



COMPLETE DESIGN-ENGINEERING SERVICE

There is a Cuno Field Engineer located in your area. To help solve your design problems, this trained specialist offers you *more years of experience* in removing *more sizes of solids* from *more kinds of fluids.*

New DESIGN DATA . . . **MICRO-KLEAN FILTER** *combines fine filtration and high flow rates with important time- and space-saving advantages. Write now for your free copy of Catalog No. 53-100.*

CUNO

CUNO ENGINEERING CORPORATION
207 SOUTH VINE STREET, MERIDEN, CONN.
Filtration Engineers in Principal Cities

Circle 35 on Reader Service Card

Circle 34 on Reader Service Card

RUGGED, HEAVY-DUTY
HYDRAULIC CYLINDERS

Attention: O. E. M.
Prompt delivery on any quantity . . .
high quality . . .
low cost!

Built-in Mechanical Stroke Control

Free catalog and engineering survey, no obligation.

WRITE...PHONE...WIRE
CROSS MFG. CO.
LEWIS ■ PHONE 86 ■ KANSAS

New Products continued

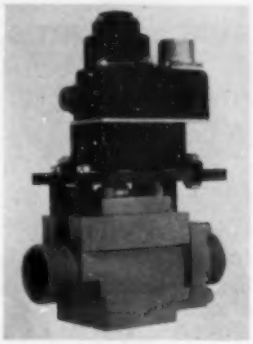
A check valve stops bellows air from flowing back into the supply line in the event of supply failure. The exhaust valve also acts as a safety relieving bellows.

Republic Manufacturing Company
Cleveland, Ohio

Circle 175 on Reader Service Card

SHUT-OFF VALVE
. . . for cryogenic media

Features: The valves offer reliable, bubble-tight flow control of extremely low temperature (—320F) and high pressure (3000 psi) media. Gases and liquids handled include: oxygen, nitrogen, air, helium, liquid oxygen, liquid nitrogen, and liquid air. The floating ball-seat valve arrangement, with self-wiping and self-lapping action, insures long, trouble-free life. Axial hole-in-a-ball design provides unobstructed, smooth flow path. Current is automatically shut off at the end of each valve cycle. In either the open or closed position, the valve is positively locked.



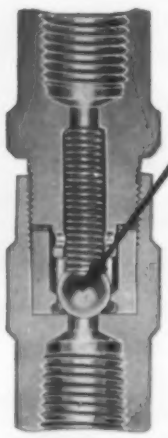
Specifications: Operating times are from 0.5 sec to 5.0 sec. The valves have an aluminum body, aluminum and hard chromed stainless steel internal parts; Mylar, Kel-F and Teflon seals. Sizes range from ¼ in. to 1½ in.

Hydromatics, Inc.
Cedar Grove, N. J.

Circle 176 on Reader Service Card

Continued on page 134

Point of No Return in HOKE



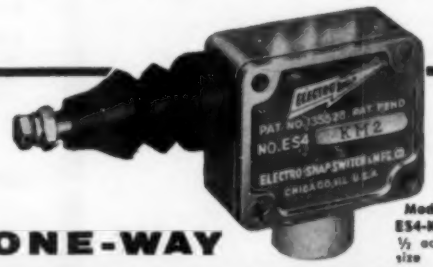
Ball Type CHECK VALVES

Hoke ball-type check valves are precision engineered for minimum flow resistance and positive reverse flow check. Synthetic rubber seats and stainless steel springs give maximum corrosion resistance and long service life. Line pressures to 3000 psi. Stock sizes, ⅛" and ¼" in stainless steel and brass. Larger sizes or other materials to your requirements. Complete information is yours for the asking.

See us at Des. Eng. Show, N. Y. May 20-23

HOKE
HOKE INCORPORATED
Fluid Control Specialists
187 S. DEAN STREET, ENGLEWOOD, N. J.

Circle 66 on Reader Service Card



Model ES4-KM2 ½ actual size

ONE-WAY IMPULSE SWITCH
simplifies sequencing circuits

★ Eliminates Interlocking Switches and Complicated Actuating Dogs
★ Exclusive one-way actuator sends electrical pulse when depressed, then opens circuit. No pulse on actuator return.
★ Gives More Dependable Operation — replaces complicated controls
★ Lowers Cost of Control Circuits—fewer switches required
★ Faster Automatic Operation — closer sequencing possible

10 amps, 125v AC
Four models available with pulsing strokes from 1/16" to 3/8".
Described in Data Sheet ESF-7

$10.50 plus 25c shipping
Write for Quantity Discounts

ELECTRO SNAP

ELECTRO-SNAP SWITCH & MFG. CO.
4224 W. Lake St., Chicago 24, Ill.

Circle 41 on Reader Service Card

Now... hydraulic assemblies made by a *hose* manufacturer

For the first time a world-known *hose manufacturer* offers a hydraulic hose *assembly* specifically engineered for every industrial need—construction equipment, farm machinery, machine tools, presses, lifts and other hydraulic equipment.

There are two important advantages in buying Gates Hydraulic Assemblies:

1. Gates is able to offer *over-all* quality control.
2. Gates, with a nation-wide engineering and service organization of its own, is in a *unique* position to advise, assist and supply manufacturers of machines, vehicles and equipment which use hydraulic systems.

Call your nearest Gates Engineering Office for help in solving hydraulic hose assembly problems. Quickly available stocks in all principal cities.

The Gates Rubber Company
Denver, Colorado

Gates High Pressure Hydraulic Hose (54MB) meets or exceeds SAE specifications

This smooth-covered, easy-to-keep-clean hose has reinforcing braid of extremely flexible high-tensile wire, made specially for this use. Black, oil-resistant rubber withstands heat, abrasion and weather exposure. Recommended for systems subjected to shock loads and heavy pulsating pressures.

Gates Medium Pressure Hydraulic Hose (19HB)

Same quality construction, but with braided cord reinforcement—more than adequate for the lower pressure applications.

Gates®

Gates Distributors are in the **Yellow Pages**

The Mark of *Specialized* Research

Gates Hydraulic Hose

TPA 193 A

Circle 52 on Reader Service Card

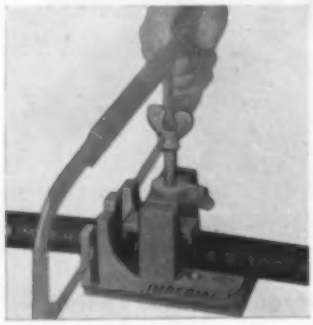
New Products continued

SAWING VISE

. . . for cutting pressure hose

Designation: No. 384-F

Features: The vise provides a quick, easy way of sawing wire braid hose with minimum wear on the saw



blade. Hose sizes to 1½ in. OD can be cut. The hose is held very tightly by a special gripper, and is always cut cleanly and squarely, ready for tight connection. The saw blade can be used many times. Vise can also be used for cutting tubing. It has a ratchet-type slide-to-size adjustment.

Imperial Brass Mfg. Co.
Chicago, Ill.

Circle 177 on Reader Service Card

DIAPHRAGM SEAL

. . . operates to 500F

Features: By combining a glass fabric with a new silicone rubber, a diaphragm seal has been developed which will function from —80 to 500 F. The seal was designed to solve some aircraft high temperature problems, especially in pneumatic and fluid systems.

Specifications: Although still in the pilot stage and subject to certain limitations, one with a cylinder bore of 2-in., a ½-in. height and a 5/16-in. stroke, at 50 psi delivered 250,000 cycles at 500 F. Present military requirements call for a cycle life of 50,000 cycles for diaphragms of this type.

Bellofram Corp.
Burlington, Mass.

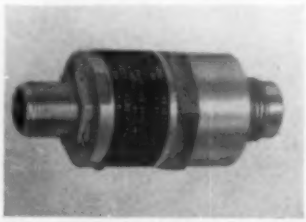
Circle 178 on Reader Service Card

MINIATURE PILOT VALVE

. . . for pressures to 4500 psi

Designation: model MV-137-G

Features: This three-way, normally-open, magnetically-operated miniature pilot valve weighs only 6 oz., yet is rated up to 4500 psi. A 14-32 volt hermetically sealed solenoid controls the flow through what is



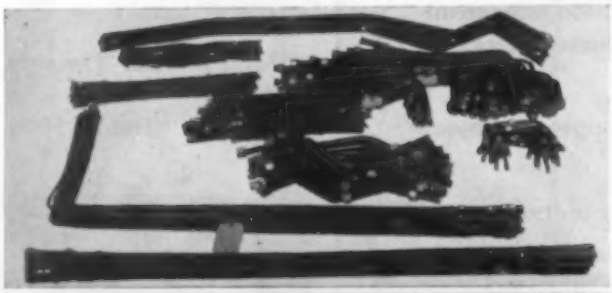
equivalent to a sharp edge orifice; diameter—0.030 in. Used for piloting large valves, it is presently employed in aircraft starter systems.

Continued on page 136

HYDRAULIC CONNECTIONS TUBED TO FIT

Designed for your job — easily installed — ready to run

Wallace offers fifty years of experience. Simple connections, low fitting costs, long service life, easy access.



We include layout—tubing—fittings—bends—valves.

Flare, flareless, welded, flange or hose fittings.

Lines designed to suit your production conditions.

Ask for tube-connection data sheet.

WALLACE SUPPLIES MFG. CO.

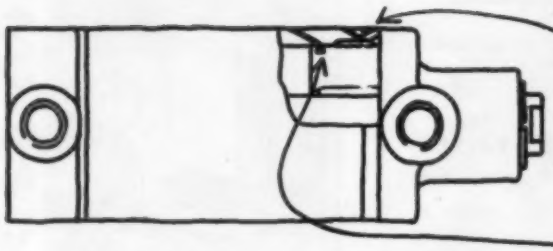
1302-12 WEST WOLFRAM STREET **CHICAGO 13, ILLINOIS**

INTER-OFFICE

Engineering Department

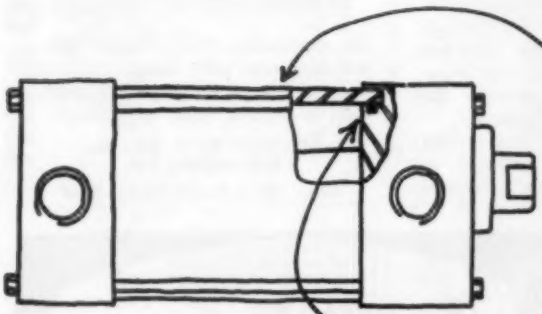
MEMO

Jim - Here's why I think Pathon Hydraulic Cylinders fit our long stroke applications better.



Pathon head is attached by a single screw thread.

Head seal is a true static seal - will give us much longer life.



Higher pressures will stretch the tie-rods on this cylinder - heads will move relative to the tube

This makes head seal dynamic - subject to wear and subsequent trouble

NOTE THIS JIM: Pathon Cylinders fit the bill in shock loads too. We can use the greater strength that Pathon single screw thread attaching method provides.

Tell purchasing to write

PATHON MANUFACTURING CO.
3823 PACIFIC AVE.
CINCINNATI 12, OHIO

ask for catalog #22-A

Ψ could designate P. S. I. - 101

Circle 97 on Reader Service Card

Circle 98 on Reader Service Card

HAND HYDRAULIC PUMPS

Single and Double Designs to 20,000 PSI With or Without Reservoir

160 Cubic Inch Reservoir with 8" x 8" Base Plate. Optional Size Piston: ⅜", ½", ¾", 1".

Handle length: 18 inches

Catalog No. 160

We specialize in hand pump units to operate in temperatures from minus 65F to plus 160F and with any capacity reservoirs required.

The single pump with ½" or ¾" piston now available in stainless steel.

WILLIAM S. PINE

Hydraulic Hand Pumps for 1001 Uses

1635 E. 22nd St., Los Angeles 11, Calif.

New Products continued

Specifications: It has an ambient temperature range of —100 F to 250 F. Its fluid temperature range is —65 F to 250 F.

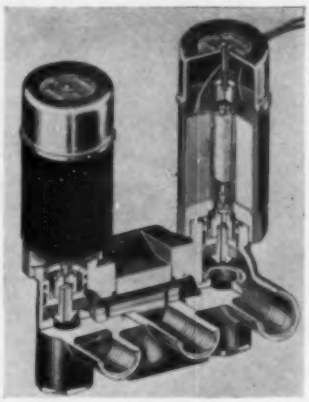
Maretta Valve Corporation
Boonton, N. J.

Circle 179 on Reader Service Card

DOUBLE SOLENOID VALVE . . . for 3-way flow control

Features: The valve is available in three assemblies: (1) as a mixing valve, with two inlets and a common outlet; (2) for divided flow, having one inlet and two outlets; and (3) as a cylinder control valve, with an inlet, cylinder and exhaust connections. The packless valve has two pilot-piston units, each separately controlled, to provide the specified 3-way flow control.

Specifications: The valve is bubble tight, with pressures from 5 to 1000 psi both pistons normally closed, and 5 to 500 psi with either or both pistons normally open. It



has replaceable, resilient main discs, stainless steel pilot assemblies and unbreakable piston rings. It is available in ½ and ¾-in. pipe sizes.

Atkomatic Valve Co., Inc.
Indianapolis, Ind.

Circle 180 on Reader Service Card

Send for this **FREE BROCHURE** showing how

CROWN

HYDRA-TROL

Remote Control

- Has positive stroke in both directions.
- Does not depend on spring return or outside power sources.
- Immediate synchronization of system in either direction.
- Is a self-contained hydraulic system for positive positioning of remotely-located levers, shafts, and other equipment.
- Valuable in controlling hydraulic valves, winches, throttles, slitting machines, butterfly valves, etc.

Write for bulletin A

Crown Control Division

of

TRIMOUNT INSTRUMENT COMPANY

3119 WEST VAN BUREN STREET • CHICAGO 12, ILLINOIS

2568

REMOVE MOISTURE from

COMPRESSED AIR LINES

Air operated tools, instruments and controls demand air that is

COOL CLEAN & DRY

and the

MURPHY AFTERCOOLER SYSTEM

GUARANTEES IT!

Write now for **FREE** Data Sheet No. 2568.

JAMCO

JAS. A. MURPHY & CO., INC.

1417 EAST HIGH STREET, HAMILTON, OHIO

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PERMIT No. 8066
SEC. 34.9 P. L. & R.
CLEVELAND, OHIO

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Company _____ Kind of Business _____

Street _____

City _____ Zone _____ State _____

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1	18	35	52	69	86	103	120	137	154	171	188	205	222	239	256	273	290	307	324
2	19	36	53	70	87	104	121	138	155	172	189	206	223	240	257	274	291	308	325
3	20	37	54	71	88	105	122	139	156	173	190	207	224	241	258	275	292	309	326
4	21	38	55	72	89	106	123	140	157	174	191	208	225	242	259	276	293	310	327
5	22	39	56	73	90	107	124	141	158	175	192	209	226	243	260	277	294	311	328
6	23	40	57	74	91	108	125	142	159	176	193	210	227	244	261	278	295	312	329
7	24	41	58	75	92	109	126	143	160	17.	194	211	228	245	262	279	296	313	330
8	25	42	59	76	93	110	127	144	161	178	195	212	229	246	263	280	297	314	331
9	26	43	60	77	94	111	128	145	162	179	196	213	230	247	264	281	298	315	332
10	27	44	61	78	95	112	129	146	163	180	197	214	231	248	265	282	299	316	333
11	28	45	62	79	96	113	130	147	164	181	198	215	232	249	266	283	300	317	334
12	29	46	63	80	97	114	131	148	165	182	199	216	233	250	267	284	301	318	335
13	30	47	64	81	98	115	132	149	166	183	200	217	234	251	268	285	302	319	336
14	31	48	65	82	99	116	133	150	167	184	201	218	235	252	269	286	303	320	33.
15	32	49	66	83	100	117	134	151	168	185	202	219	236	253	270	287	304	321	338
16	33	50	67	84	101	118	135	152	169	186	203	220	237	254	271	288	305	322	339
17	34	51	68	85	102	119	136	153	170	187	204	221	238	255	272	289	306	323	340

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1	18	35	52	69	86	103	120	137	154	171	188	205	222	239	256	273	290	307	324
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3	20	37	54	71	88	105	122	139	156	173	190	207	224	241	258	275	292	309	326
4	21	38	55	72	89	106	123	140	157	174	191	208	225	242	259	276	293	310	327
5	22	39	56	73	90	107	124	141	158	175	192	209	226	243	260	277	294	311	328
6	23	40	57	74	91	108	125	142	159	176	193	210	227	244	261	278	295	312	329
7	24	41	58	75	92	109	126	143	160	177	194	211	228	245	262	279	296	313	330
8	25	42	59	76	93	110	127	144	161	178	195	212	229	246	263	280	297	314	331
9	26	43	60	77	94	111	128	145	162	179	196	213	230	247	264	281	298	315	332
10	27	44	61	78	95	112	129	146	163	180	197	214	231	248	265	282	299	316	333
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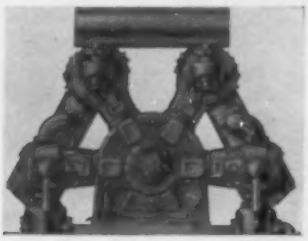
12	29	46	63	80	97	114	131	148	165	182	199	216	233	250	267	284	301	318	335
13	30	47	64	81	98	115	132	149	166	183	200	217	234	251	268	285	302	319	336
14	31	48	65	82	99	116	133	150	167	184	201	218	235	252	269	286	303	320	337
15	32	49	66	83	100	117	134	151	168	185	202	219	236	253	270	287	304	321	338
16	33	50	67	84	101	118	135	152	169	186	203	220	237	254	271	288	305	322	339
17	34	51	68	85	102	119	136	153	170	187	204	221	238	255	272	289	306	323	340

AIR COMPRESSOR

. . . delivers 6000 CFM

Designation: WN-224

Features: The compressor is a four-cylinder, double-acting, water-cooled machine of semi-radial design, achieving final pressure in two stages. Output at 80-125 psig is rated from 2418 to 6048 cfm, de-



pending on motor hp. Three single models and three twin unit models are available. Twin units are two standard compressors powered by one motor. Drive may be by electric motor, diesel engine, steam turbine, or turboelectric combinations.

Specifications: The compressor measures 9 ft. 8 in. high by 12 ft. 8 in. wide. Length varies from 8 to 14 feet. Single units weigh as much as 29,400 lbs.; double units weigh over 65,000 lbs.

Joy Manufacturing Co.
Pittsburgh, Pa.

Circle 181 on Reader Service Card

MIDGET SOLENOID VALVE

. . . saves space

Designation: K-27H

Features: Designed for the automatic equipment manufacturing field where savings in space and

production costs are critical. Applications include gas or liquid flow control in automatic production machinery and test benches. Operation is positive in any position, including side or inverted mounting.

Specifications: This shut-off valve is only ⅜-in. high and 1⅞-in. dia. Unit is available in ⅛ ips, is nor-

Continued on next page

For pressures to 5,000 psi

STRATOFLEX
HOSE and FITTINGS

meet your specs

When you design with Stratoflex you get more than the vibration and stress resistance inherent in flexible hose. You get hose fittings designed to meet your specific requirements. Stratoflex hose and fittings are available in a wide range of types and sizes . . . lightweight for aircraft use . . . corrosion resistant for marine applications . . . Teflon* for extremely high or low temperatures . . . heavy duty, double-wire braid types for high pressure. Stratoflex leak-proof, reusable fittings make possible quick, easy replacement or modification. You simplify both design and maintenance when you specify Stratoflex.

*TEFLON is a registered DuPont trademark.

TYPICAL ASSEMBLIES

SF 212 DOUBLE WIRE BRAID HOSE with SF 320 REUSABLE SWIVEL FITTING for high pressure applications. Working pressure range: 1,125 to 5,000 psi.

SF 211 SINGLE WIRE BRAID HOSE with SF 319 REUSABLE SWIVEL FITTING for medium pressure applications. Working pressure range: 350 to 2,000 psi.

SF 124 TEFLON HOSE with SF 324 SWAGED FITTING for aircraft applications. Stays flexible from −100° to +450° F. Unaffected by all fuels, petroleum, synthetic base lubricants, acids, and solvents.

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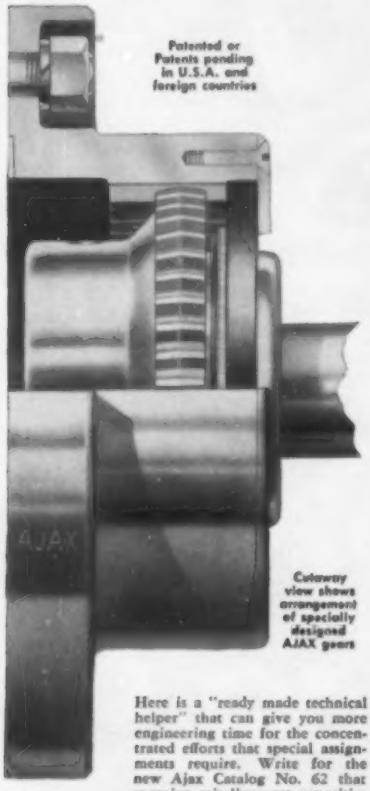
Circle 120 on Reader Service Card

AJAX

Self-aligning

DIHEDRAL COUPLINGS

Give Design Engineers An Immediate Source of Product Improvement

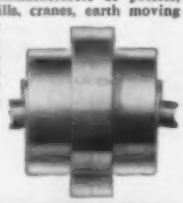


Cutaway view shows arrangement of specially designed AJAX gears

Here is a "ready made technical helper" that can give you more engineering time for the concentrated efforts that special assignments require. Write for the new Ajax Catalog No. 62 that contains misalignment capacities of every coupling size and type in the complete line of Ajax Dihedral Couplings. Why spend valuable time duplicating data already established by thousands of proven, field tested applications.

Ajax Dihedral Couplings handle unavoidable shaft misalignment, angular and offset, up to a total of 12°. Teeth can be cut to handle greater misalignment capacities on special order.

Get the facts on how manufacturers of presses, machine tools, rolling mills, cranes, earth moving and many other direct connected machines are simplifying design, cutting manufacturing costs and improving product performance with Ajax Dihedral Couplings.



Write today for your personal copy of Bulletin No. 62.

AJAX FLEXIBLE COUPLING CO. INC.
WESTFIELD, NEW YORK

New Products / continued

mally closed, and features a spring-loaded plunger with soft seat for bubble-tight shut-off, brass bar stock body and two-wire continuous duty solenoid. Suitable for use with all common industrial fluids including water, oil, gas and air, at operating pressures up to 130 psi.

General Controls Co.
Glendale, Calif.

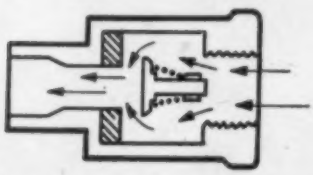
Circle 182 on Reader Service Card

SMALL PNEUMATIC COUPLING

. . . passes 60 cfm

Designation: PT series.

Features: These new, lightweight pneumatic couplings direct the airflow around the spring when it is compressed, instead of through it. The coupling sleeve does not have to be retracted to insert the connector. The coupler has a stainless steel shutoff valve, and is fully piloted to prevent cocking.



Specifications: In the ¼-in. size, an airflow of 60 cfm at 100 psi is possible. The ⅜-in. size permits a flow of 100 cfm at 100 psi. The coupler weighs 2½ oz. Maximum O.D. of the ¼-in. sleeve is 15/16.

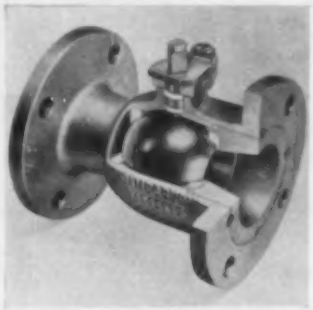
Zalo Manufacturing Co.
Cleveland, Ohio

Circle 183 on Reader Service Card

BALL VALVES

. . . eliminate valve bonnet

Features: These 3 in. and 4 in. ball valves, through unit body construction, have eliminated the valve bonnet; a primary cause of leakage. The unit-body construction assures no joint leakage points, thus making these ball valves effective in any installation. They feature full-flow and quarter-turn operation and are currently used in the petroleum, atomic energy, vacuum and food processing industries.



Specifications: The valves are made of aluminum, bronze, 316 stainless steel and carbon steel. Seat and seals available in Buna-N, Neoprene, Teflon and synthetic rubbers. Remote controlled operators can be supplied for these valves.

Jamesbury Corporation
Worcester, Mass.

Circle 184 on Reader Service Card

PNEUMATIC SELECTOR VALVE

. . . for dry air or nitrogen

Designation: Model 9905

Features: This minaturized valve is designed to handle dry air or nitrogen in aircraft applications. It features minimum size and weight,

low leakage, low operating torque, non-interflow and safety torque override. The valve has a forged aluminum alloy housing. It requires only 12 in-lb handle torque at full operating pressure. To insure against

Continued on page 140

Circle 51 on Reader Service Card

BIG NEW fan-cooled rotary model 4565

GAST ROTARY AIR PUMPS

deliver 45 C. F. M. — double the capacity of previous models!

•

AS COMPRESSOR: 45 c.f.m., to 20 p.s.i.g. continuously with 5 h.p. at 1750 r.p.m.

•

VACUUM PUMP: 45 c.f.m., vac. to 25 in. hg. with 3 h.p. motor, 35 c.f.m. with 2 h.p.

•

Write for Bulletins 557-VP

Now ..... bigger–volume utility for original equipment or plant use! Built as either Compressor or Vacuum Pump for continuous, heavy-duty service. Air-cooled by 10" diameter pitch fan. Cowl-guard directs air—eliminates water-cooling headaches.

Long-lived, efficient 5-vane rotary design — positive, pulseless air delivery — needs no tank. Easy-to-mount v-belt drive. Three rows of ball bearings. Weight only 92 lbs.! Many applications.

Gast Manufacturing Corp., P.O. Box 117-D. Benton Harbor, Mich.

Original Equipment Manufacturers for Over 25 Years

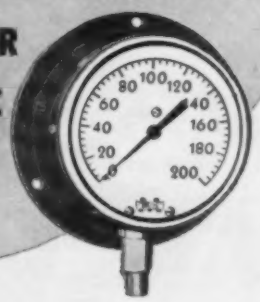
GAST ROTARY

- AIR MOTORS TO 4 H.P.
- COMPRESSORS TO 30 P.S.I.
- VACUUM PUMPS TO 28 IN.

See Our Catalog in Sweet's Product Design File

MARSHALLTOWN

THE RIGHT GAUGE FOR YOUR SPECIFIC NEEDS



- PRESSURE
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- DIAL THERMOMETERS

(Vapor Tension or Bi-Metal)

• Available in a wide variety of general purpose and special purpose gauges in pressure ranges to meet your specifications in every particular.

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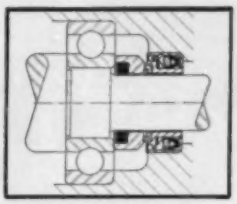
MARSHALLTOWN MANUFACTURING CO.

800 EAST NEVADA ST. Marshalltown 4, Iowa

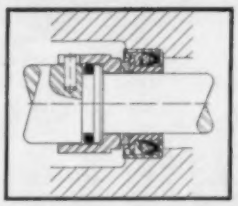
For Proper Sealing . . . DEPEND ON THE SEALOL ENGINEER!

Shaft Seals Function Best When Properly Engineered To The Job

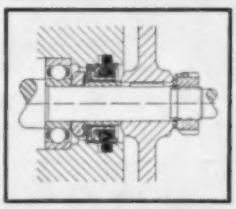
The typical examples shown below indicate the variety of methods possible in the application of mating rings for Sealol seals.



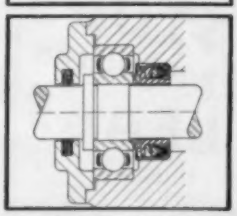
This mating ring is a push fit on the shaft. Interference is at the rubber packing, not metal to metal. The packing both drives and seals. Ring is squared by bearing or shoulder. Not recommended for high pressure applications as ring is hydraulically overbalanced away from shoulder. Seal is press fit in housing.



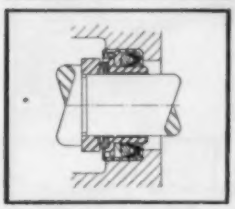
This mating ring is a slip fit on the shaft and positioned against shoulder. Ring is sealed to the shaft by the "O" ring in a groove and is driven by the pin. This ring is hydraulically overbalanced *toward* the shoulder and is, therefore, suitable for high pressure applications.



This mating ring is a close tolerance slip fit on shaft, held against bearing or shoulder by mechanical make-up. This make-up provides drive and leak-tightness to shaft. In this picture the seal is a slip fit in housing for easy assembly and removal and sealed to housing by an "O" ring.



This mating ring is actually the inner ring of the bearing. The inner ring must be mounted leak-tight to the shaft and positively driven (press fit). The ring face must be lapped flat and smooth. This arrangement saves space but its use is limited by the amount of frictional heat input the bearing will accept and by the limitation of choice of material.



This mating ring is a press or shrink fit on the shaft, positioned by shaft shoulder. This method requires close tolerance dimensional control of shaft and ring hole diameters. Since press or shrink fit can distort previously prepared face, this type ring is recommended only when other solutions are not practical.

These examples illustrate the necessity for decisions. The Sealol Engineer can make these decisions for you based on intimate knowledge and experience. Consult him for solutions of your shaft sealing problems.

SEALOL CORP

181 Post Road, Providence 5, R. I.

Charleston, W. Va. • Chicago • Cleveland • Denver • Houston • Los Angeles
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Manchester (Eng.) • Paris • Frankfurt

SEALOL

THE BALANCED PRESSURE SEAL

New Products continued

mixing during position selection, all ports in this non-interflow type valve automatically close while the selection is being made.

Specifications: The valve has a nominal operating pressure of 600 psi, proof pressure of 3750 psi and a bursting pressure of 7500 psi. Its operating temperature ranges from —65 F to 225 F, and its flow factor is .033 scfm per psia minimum.

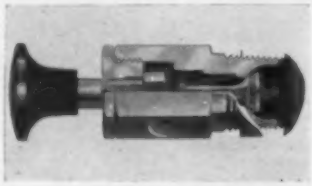
Tactair Valve Div.
Aircraft Products Co.
Bridgeport, Pa.

Circle 185 on Reader Service Card

DUAL FUNCTION VALVES
. . . for tank or fluid systems

Designation: Model P-646

Features: These valves are designed to automatically break the vacuum during draining, and bleed the air displaced during filling. When fluid is being withdrawn from the system, or temperature drops, the valve opens automatically to break the vacuum and permit free flow.



A manual over-ride is provided to permit holding the valve open to release entrapped air when the system is being filled. The O-ring design guarantees dead-tight shut off to hold tank pressure. The floating poppet design provides self-cleaning operation. Made of aluminum the valve is available in ½-in., and ¾-in. sizes.

Circle Seal Products Co., Inc.
Pasadena, California

Circle 186 on Reader Service Card

½ INCH AIR FILTER
. . . is fully automatic

Designation: L-200A-½ in.

Features: The filter eliminates moisture, sludge and other foreign substances heavier than air from entering air operated devices. Internal parts have been plated to pass a 100-hour salt spray test. The new unit has been designed to filter air for pneumatic equipment operating on intermittent air flow.

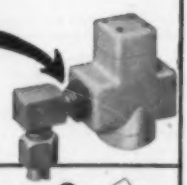
Specifications: Maximum capacity is 90 cfm, with working pressures to 300 psi.

Emco Pneumatic Corp.
Des Moines, Iowa

Circle 187 on Reader Service Card

TRU-O-SEAL
TEFLON SEAL
PAT. PENDING

STOPS PIPE THREAD LEAKS



Satisfaction Guaranteed Or Money Back TRIAL OFFER

TRU-O-SEAL Fittings are guaranteed to seal pipe thread connections permanently against all oils, practically all known chemicals and gases; to seal under high pressures or vacuum; to withstand —280° to plus 500° F.; to eliminate "overtightening" damage and pipe dope. Available in ⅛" to 2½" pipe thread sizes.

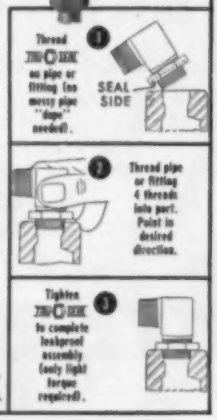
$10.00 Trial Offer No. 1: eight ⅛", ten ¼", eight ⅜", ten ½" pipe thread TRU-O-SEAL Fittings.

$10.00 Trial Offer No. 2: eight ½", ten ¾", four 1" pipe thread TRU-O-SEAL Fittings.

Send order to

TRU-O-SEAL DIVISION
Flick-Reedy Corporation

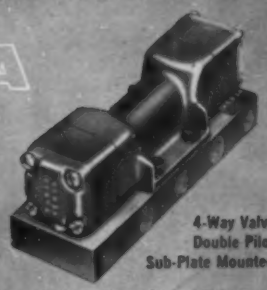
2008 N. Hawthorne • Melrose Park, Ill.
"Miller Fluid Power" is also a Div. of Flick-Reedy Corp.


1
Thread TRU-O-SEAL on pipe or fitting (no messy pipe "dope" needed).
SEAL SIDE
2
Thread pipe or fitting 4 threads into port. Point in desired direction.
3
Tighten TRU-O-SEAL to complete leakproof assembly (only light torque required).

Circle 127 on Reader Service Card

FOR SUB-PLATE MOUNTING

VERSA Manifold Mount VALVES



4-Way Valve
Double Pilot
Sub-Plate Mounted

For any type of operation...there's a Versa Control Valve available for manifold mounting. These efficient, compact Control Valves are ideal for incorporation as original equipment. They can be installed directly on equipment or mounted on standard Manifold Plates (or Sub Plates).

Versa Manifold Mount Valves are available with any type of actuating device, in sizes from 1/8" to 1" NPT, in 2-, 3-, 4-, and 5-Way Types, and for pressures from partial vacuum to 500 PSIG.

Over 110,000 Variations...
Available for Immediate Delivery!

VERSA

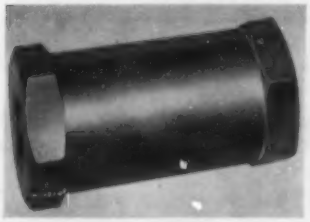
VERSA PRODUCTS COMPANY INC.
248A SCHOLES STREET, BROOKLYN 6, N.Y.

Circle 132 on Reader Service Card

CHECK VALVE

. . . has one moving part

Features: The new aluminum check valve offers light weight and sim-



ple construction. It weighs only four ounces. The poppet is the only moving part.

Specifications: Available in two models, ½ in. and ⅜ in. pipe size, the check valve has a differential cracking pressure of 1 psi max. Differential sealing pressure is less than 1 psi. The lightweight unit withstands operating pressures to 125 psig and temperatures to 175 F.

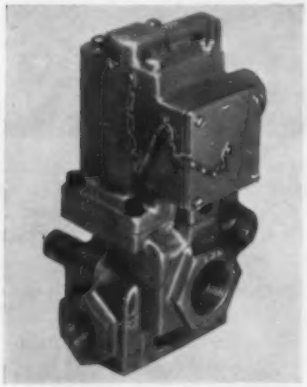
Ross Operating Valve Co.
Detroit, Mich.

Circle 188 on Reader Service Card

SOLENOID AIR VALVE

. . . mounts direct to cylinder

Specifications: Unit is pilot operated, poppet type, made to JIC standards, and has four watertight and dust-tight solenoid enclosures. Recessed pin can be locked in or out to operate valve manually without removing cover. Lightweight aluminum construction and in-line cylinder and inlet ports allow



mounting directly to cylinder to save on piping and air. Can be used in pairs to control double-acting cylinders. Furnished in ¼, ⅜, ½, ¾, 1 and 1-¼ in. sizes, normally open or normally closed, with continuous duty solenoids.

Automatic Valve Co.
Farmington, Mich.

Circle 189 on Reader Service Card

Continued on next page

Barco Joints For Hydraulic Clutches

BARCO *Ball Bearing*
Single Plane SWIVEL JOINT
SIZES:
¼" ⅜" ½" ¾"

Above—Efficient, smooth-working hydraulic operating control is one of the outstanding features of popular Thew-Lorain Moto-Crane, Model MC-107, power shovels and cranes. The arrows point to ¼" Barco ball bearing type single plane swivel joints used in the assembly.

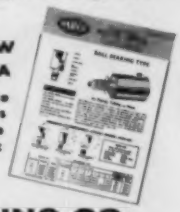
Compact! Simple! Dependable!

MACHINE designers and builders are finding Barco's new ball bearing type single plane swivel joints remarkably adaptable and versatile for hydraulic and pneumatic service on construction equipment and other machinery of ultramodern design. In the service illustrated above, the joints rotate at speeds up to 78 RPM under medium hydraulic pressure. In other applications, pressures to as high as 2,000 psi can be accommodated.

These joints are of sealed, unitized construction requiring no maintenance. Small and compact—yet rugged. They are also widely used as swivel hose connectors to *prevent kinking* and *twisting of hose* and to permit use of shorter lengths of hose.

SEND FOR NEW BULLETIN 406A

gives details on Barco single plane swivel joints and their application to hydraulic and pneumatic service.



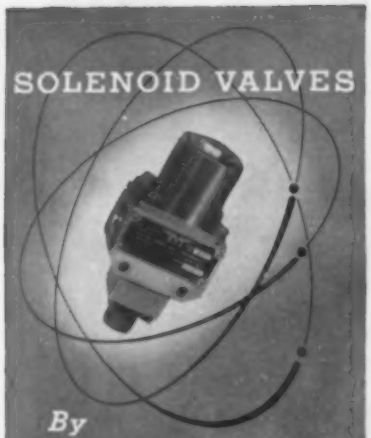
FOUNDED 1908 BARCO PRODUCTS BACKED BY EXPERIENCE

BARCO MANUFACTURING CO.
532H Hough Street • Barrington, Illinois

The Only Truly Complete Line of Flexible Ball, Swivel, Swing and Revolving Joints
In Canada: The Holden Co., Ltd., Montreal

Circle 15 on Reader Service Card

SOLENOID VALVES



By
M.C. MFG. CO.

The one shown is:
MC 2644-1 VALVE—SHUT OFF SOLENOID OPERATED
fulfilling the following aircraft specifications:
FLUID: Air or Nitrogen
PRESSURE RANGE: 0 to 1500 psi
TEMPERATURE RANGE: —65°F to +160°F
FLOW FACTOR: F=.05
INTERNAL LEAKAGE: 10 cc/min. max. at 18 to 30 volt DC, 200 to 1500 psi inlet pressure
EXTERNAL LEAKAGE: Zero
SOLENOID: Continuous duty
Voltage range 18 to 30 volt DC
1.5 amps max. at 27 volt DC
PORT CONNECTIONS: Per AND 10050-4
WEIGHT: .9 lbs.
MILITARY SPECIFICATION: Applicable paragraphs of MIL-P-5518 and MIL-P-8564

Hydraulic and Pneumatic Components for the Aircraft Industry

VALVES OF ALL TYPES: Relief • Solenoid • Manual Control • Transfer • Shuttle • Brake • Control • Fluid • Pressure Reducing • Restrictor and Special

ALSO: Air Compressors • Fuel Pumps • Dehydrators

M.C. MANUFACTURING CO.
118 INDIANWOOD ROAD
LAKE ORION, MICHIGAN

West Coast Office: 716 Wilshire Blvd. Santa Monica, Calif.

Representatives:
D. & O. ENGINEERING CO.
P.O. Box 3107, Wichita, Kansas

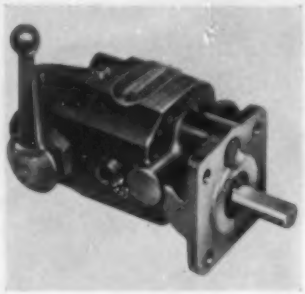
F. C. MINCH
1132 Denson Drive, Dayton 10, Ohio

New Products continued

NEW PUMP

. . . for controlled flow

Features: The pump is provided with a speed control valve to handle maximum pump capacity. From full flow to zero output can be obtained by rotating the handle 90 degrees.



Specifications: Pump flow ranges are: 0 to 1, 2, 4, and 6 gpm. The 0 to 4 and 0 to 6 gpm flows are obtained by running at 3450 rpm with ½ and ¾-in. gear faces. The suction port is ½-in. pipe tap, the metered flow is ½-in. pipe tap, and a ¼-in. pipe tap is provided for the return flow from the compensating stem.

John S. Barnes Corp.
Rockford, Ill.

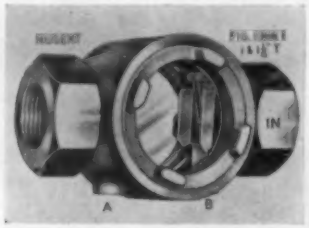
Circle 190 on Reader Service Card

FITTING

. . . to show liquid flow

Designation: Fig. 1366E

Features: The fitting indicates the flow of liquid in a pipe line, and may be installed in any position. It has a spring compensated, hinged, indicator gate which moves in proportion to the flow. The gate is visible from either side of the fitting, even when the liquid is dark or discolored. The fittings can be supplied with electrical contacts (A and B) to operate a bell or light if liquid flow should stop.



Specifications: They are available in ⅜-in. to 6-in. brass, cast iron or steel; flanged or tapped.

Wm. W. Nugent & Co., Inc.
Skokie, Ill.

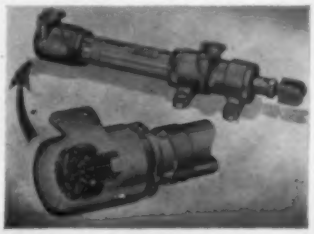
Circle 191 on Reader Service Card

SELF-LOCKING CYLINDER

. . . eliminates mechanical latch

Designation: RHUCOR self-locking cylinders.

Features: Designed specifically for aircraft doors, the cylinder combines linear actuation and mechanical locking in a single package. Envelope dimensions and weights are approximately the same as standard aircraft cylinders. They are made with steel barrels and pistons with aluminum ends and available in any required bore and stroke. The cylinder meets all applicable military specs.



Specifications: The integral lock is operated by hydraulic pressures up to 4,500 psi. It can be designed to lock and unlock at any desired pressure.

Ronson Hydraulic Units Corp.
Pasadena, Calif.

Circle 192 on Reader Service Card

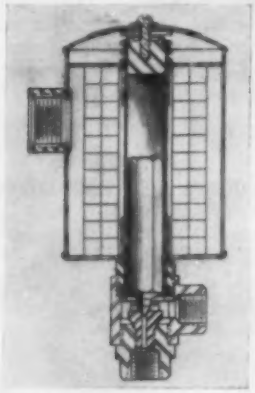
SOLENOID VALVES

. . . for corrosive fluids

Designation: ALL 316 series, type GX

Features: These valves have only 316 stainless steel and Teflon in contact with the medium flowing through the valve. The valves are normally closed. Greenclad, water-

proof molded coils are used for temperatures to 250 F and silicone insulated coils for higher tempera-



tures. Explosion proof housings are available.

Specifications: They have ⅛ in., ¼ in. and ⅜ in. port sizes with orifices from 1/16 in. to ¼ in.

J. D. Gould Co.
Indianapolis, Ind.

Circle 193 on Reader Service Card

AIRCRAFT HYDRAULIC
. . . operates at 5000 psi

Designation: 66W

Features: Design permits operation at 5000 psi with a pump weighing within ¼-lb of a standard 3000 psi pump.

Tested: Unit operated successfully for over 1000 hours of cycling endurance at 5000 psi. MIL-O-5606 oil at 160 F was used, and inlet pressure was sea level. Cycling was one cycle per minute from a full flow pressure of 4500 psi to a non-flow condition at 5000 psi.

Specifications: Pump delivers 7.5

gpm at 3750. Applications for this high pressure pump should be within the normal operating range of 3000 to 3750 rpm.

Watertown Div.
New York Air Brake Co.
Watertown, N.Y.

Circle 194 on Reader Service Card

Circle 130 on Reader Service Card

do you have a "tight seal" problem?

By tomorrow morning, this fella's problem will be solved, except for a headache. But if you have a problem with tight seals for metal-to-metal applications, it will take more than a good night's sleep—United's Metallic O-Rings, for example.

They fit any application calling for a positive, permanent seal against internal or vacuum pressures up to 10,000 p.s.i., in a temperature range from –70 to 1800°F. They are especially adaptable for sealing cylinder heads, air and hydraulic pressures, high octane fuels, vapors, gases, oils, solvents, chemicals, acids, vacuum and steam connections. Available in various metals and plating finishes, from ⅜" dia. to any size or configuration.

For free 22 page booklet describing United Metallic O-Rings, write (on your letterhead please) to Department H-2

UNITED METALLIC "O" RING CORP.
Dayton, Ohio • Box 1035
Division of United Aircraft Products, Inc.

SEND your specifications for hydraulic cylinders to American, specialists in hollow boring and honing. We manufacture from tubing or forgings in carbon or alloy steels up to 15" I.D. Over 40 years experience backed by precision machines and skilled craftsmen will save you time and money. Send your blueprints.

Telephone
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AMERICAN HOLLOW BORING COMPANY
1954 RASPBERRY STREET • ERIE, PA.

SPECIALISTS IN THE MANUFACTURE OF **HYDRAULIC CYLINDERS**

Useful Literature continued

NOISE CONTROL BROCHURE . . . is available from Allied Witan Co., Cleveland. Eight-page booklet illustrates with charts and photographs the applications of pneumatic mufflers for the elimination of noises of air-operated equipment.

Circle 232 on Reader Service Card

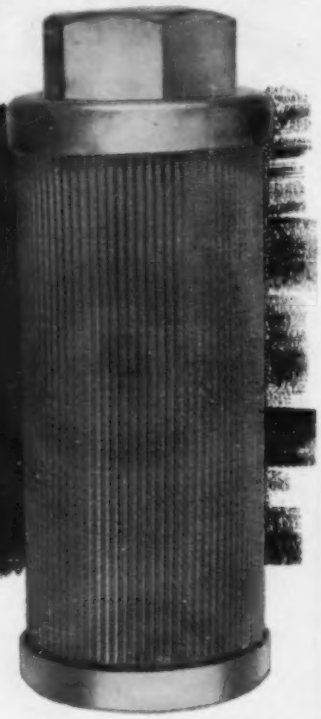
PIPE DIMENSION TABLES . . . Engineers designers and layout men involved with steel piping will be interested in two tables given in Data Folder TDC-138 issued by the Tubular Products Div., Babcock & Wilcox Co., Beaver Falls, Pa. One table lists dimensional data for 16 pipe sizes ⅛ to 8-in. for six different weight schedules, showing OD, ID, wall thickness, and weights per foot. Other table covers ASTM, ASME specifications, showing title, grade, type and analysis for various carbon, alloy and stainless steel pipe used for high temperatures and pressures, and other service.

Circle 233 on Reader Service Card

Capital

HYDRAULIC OIL FILTER with Monel Metal Insert

Reservoir Type for Hydraulic and Oil Re-circulating Machinery



EASY TO INSTALL—EASY TO CLEAN
LONG LIFE—LOW COST—SIZES AND SCREENS TO FIT YOUR NEEDS

★ ONLY THREE PARTS
★ MEETS J.I.C. STANDARDS
★ GREATER FILTERING AREA
★ SPECIAL TRAP-WEAVE MESH

Specially woven MONEL wire cloth and a new method of compact corrugation, gives triple protection with less space than other filters of like capacity. Trap-weave mesh stops thin, elongated particles with NO loss of efficiency.

Non-corrosive, non-toxic materials throughout. Easily cleaned with an ordinary brush.

Write for descriptive circular.

CAPITAL ENGINEERING & MFG. CORP.

5836 SOUTH ASHLAND AVENUE, CHICAGO 36, ILLINOIS

VANE-TYPE PUMP-MOTORS . . . are described in Bulletin SP-5-B issued by Denison Engineering Div., American Brake Shoe Co., Columbus, Ohio. Complete engineering information is given, with illustrations and drawings of the units. Detailed servicing instructions are included with an entire section devoted to service hints.

Circle 234 on Reader Service Card

PACKINGS . . . for every type of fluid power service are discussed in Catalog 56 released by The Belmont Packing & Rubber Co., Philadelphia, Pa. Also covered are important points to check to obtain maximum service from rod and shaft packings and gaskets.

Circle 235 on Reader Service Card

LIGHTWEIGHT, MINIATURE PUMPS . . . offering 10 hp in a small package, up to 3000 psi at 10,000 rpm or over, are available from the Watertown Div., The New York Air Brake Co., Watertown, N. Y. Bulletin 65W covers the variable-delivery types, and Bulletin 65F describes the fixed-displacement models.

Circle 236 on Reader Service Card

AIRCRAFT TYPE RELAYS . . . tested for operation up to 80,000 ft., are described in Bulletin SR-5R issued by A.G.A. Div., Elastic Stop Nut Corp. of America, Elizabeth, N. J. Folder gives specifications and dimensions of the models available, along with a convenient selection chart.

Circle 237 on Reader Service Card

FLOW EQUALIZER . . . and proportioner is described in Catalog 116 released by the Pacific Division, Bendix Aviation Corp., North Hollywood, Calif. Fluid power engineers will be interested in the diagrams and schematic drawings illustrating the operating principles of the unit.

Circle 238 on Reader Service Card

Continued on page 146

NOW AVAILABLE!

New TUTHILL Positive Displacement Pump-and-Driving-Motor Units Require Less Space ...Have No Couplings, Adapters or Base

• Now there are *two* means by which the problems of space, weight, time and cost can be solved in the application of hydraulic, oil burning and lubricating pumps and motors to industrial equipment.

First, the use of compact, custom-built TUTHILL "POWERMITE" pump-and-driving-motor units for original equipment manufacturers having QUANTITY requirements.

Second, the use of compact, standard, promptly-available TUTHILL pump and driving motor units *for individual applications which do not warrant custom design.*

PUMP MOUNTED ON THE MOTOR

Both provide—with no coupling, adapter, or base:

1• Important savings in space.

2• Reduced weight for less shipping and handling costs.

3• Fewer components, thus less expense.

4• Less assembly time.

A typical standard TUTHILL pump-and-driving-motor unit is shown above. Note that *the pump is mounted on the motor*...eliminating the need for coupling, adapter and base...and time normally required for their assembly. In comparison with a regular assembly, the new driving unit saves a minimum of 6 inches in space and weighs several pounds less. The TUTHILL rotary positive displacement pumps used in these driving units range in flow capacity from 20-300 GPH and in pressures up to 1500 PSI. The combinations include ¼ HP motors and larger.

...WHICH REDUCES COST AND TIME ($$) TOO

FOR THE OCCASIONAL USER

These latest TUTHILL units extend the advantages of our compact, original equipment design to the occasional user of pump-motor units—the industrial firm interested in individual or minimum quantity orders and prompt delivery.

TUTHILL Positive Displacement motor-and-pump units offer a wide variety of combinations for use in hydraulic, oil burning, lubricating and other services involving many different fluids. The model shown has a capacity of 90 GPH and a ¼ HP motor with a speed of 1750 RPM.

Use the attached coupon—or write TUTHILL PUMP CO.

TUTHILL PUMP COMPANY
981 East 95th Street, Chicago 19, Illinois

Please forward complete information on the new TUTHILL pump-and-driving motor units:

☐ for small quantity application
☐ for large quantity application by original equipment manufacturer
☐ please have your representative call

NAME_____ TITLE_____

COMPANY_____

STREET_____

CITY_____ STATE_____

Tuthill Manufactures a Complete Line of Positive Displacement Rotary Pumps in Capacities from 1 to 200 GPM, for Pressures to 600 PSI, Speeds to 3600 RPM.

TUTHILL PUMP COMPANY

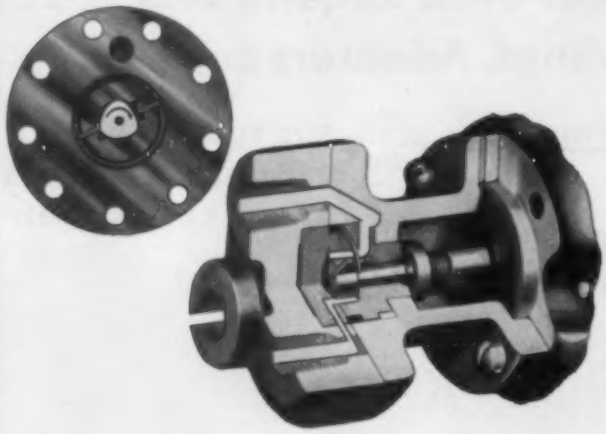
981 East 95th Street, Chicago 19, Illinois
Canadian Affiliate:
Ingersoll Machine & Tool Company, Ltd., Ingersoll, Ontario, Canada

PUMPS FOR YOUR PURPOSE

WELDON

FLUID METERING PUMPS

Positive Displacement Rotor Type. For Industrial Applications, Aircraft Anti-Icing and Aircraft Fuel.



IT'S SO SIMPLE!

The rotation of the rotor draws the fluid in through two passages, filling the cavities formed by the three lobes of the rotor. This fluid is sealed within these small cavities until it is forced through the two outlet holes by the floating blades. The flow may be kept uniformly divided through two outlet ports, or may be combined internally for passage through a single port.

Compact • Light Weight

Send for Weldon Manual and Catalog with detailed specifications and installation drawings, covering the full range of Weldon pumps in various capacities. Specify your requirements.

THE WELDON TOOL COMPANY

3000 WOODHILL ROAD · · · CLEVELAND 4, OHIO

Useful Literature / continued

OIL-LESS COMPRESSORS . . . are described in Bulletin GO-1156 released by Bell & Gossett Co., Morton Grove, Ill. Units are designed with graphite piston rings and skirts, eliminating the need for oil. Clean, oil-free air is delivered without requiring oil separators.

Circle 239 on Reader Service Card

HYDRAULIC RELAY . . . using the principle of jet stream relay, is described in Bulletin 1-001 available from The North American Mfg. Co., Cleveland. Operating principle of the unit is described and illustrated with cutaways.

Circle 240 on Reader Service Card

DOUBLE PRESSURE PUMPS . . . are made by Logemann Brothers Co., Milwaukee, Wis., for 1000 to 3000 psi service. Bulletin 195 gives details and specifications on the helical-gear and spur-gear models. Units can be made for pressures as high as 50,000 psi.

Circle 241 on Reader Service Card

AIR CYLINDERS . . . double-acting, from 1½ to 6-in. bore, are covered in Bulletin 257 published by the Sheffer Corp., Cincinnati, Ohio. Folder gives dimensional drawings and complete specifications.

Circle 242 on Reader Service Card

HYDRAULIC CYLINDERS . . . for mobile equipment service are produced by Be-Ge Mfg. Co., Gilroy, Calif. Catalog CY-530 gives an expanded cutaway drawing of the cylinder, with complete dimensional information and specifications.

Circle 243 on Reader Service Card

RETAINING RING MANUAL . . . giving 20 pages of applications and specifications for Spirolox retaining rings, is available from Thompson Products, Inc., Piston Ring Div., St. Louis, Mo. Illustrations show insertion or removal without use of special tools. Rings are easily adaptable for use with fixtures for automatic production line installation.

Circle 244 on Reader Service Card

PURIFIERS . . . mist extractors, and strainers are among the items described in Bulletin 801 available from V. D. Anderson Co., Cleveland. Various applications are shown, along with drawings explaining operation of the units.

Circle 245 on Reader Service Card

METAL BELLOWS SEALS . . . are produced by Cartriseal Corp., Lincolnwood, Ill. Available bulletin gives complete information, with illustrations showing design features of these units.

Circle 246 on Reader Service Card

ELECTRIC MOTORS . . . manufactured by Sterling Electric Motors, Los Angeles, are described in their condensed catalog. Items covered include AC squirrel-cage motors, gear motors, speed reducers and variable-speed drives. A table of useful engineering information is also given.

Circle 247 on Reader Service Card

TUBE FITTINGS CATALOG . . . listing all sizes and types of brass fittings manufactured by the Weatherhead Company, Fort Wayne, Ind., is available. One section shows the complete line of drain and shut-off cocks. Other items covered include assembly instructions on all brass fittings, data on right and wrong ways for tubing a system, tube fitting data and tools.

Circle 248 on Reader Service Card

TIMERS . . . for every type of industrial application are covered in Catalog 323 published by the Haydon Mfg. Co., Inc., Subs. of General Time Corp., Torrington, Conn. Details and specifications are given on various units, including reset and interval timers, elapsed time indicators, fixed-interval, repeat-cycle models.

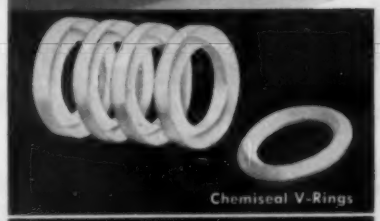
Circle 249 on Reader Service Card

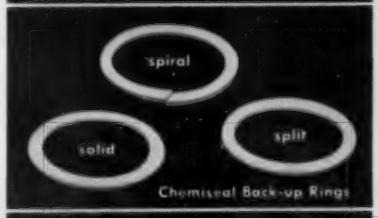
QUICK-CONNECT COUPLING . . . using Teflon and permitting previously impossible fluid transfer, is available from Snap-Tite, Inc., Union City, Pa. Bulletin on this HK unit gives complete specifications and a fully detailed cutaway showing all working parts. Coupling functions satisfactorily between —100 and 500 F and offers maximum corrosion resistance and minimum maintenance.

Circle 250 on Reader Service Card

Continued on next page

preferred by leading hydraulics engineers





TEFLON* packings are preferred by leading hydraulics engineers because they provide maximum security at vital points.

Chemiseal† packings, made of TEFLON, are chemically impervious, require no chemical inspection, have zero swelling in all hydro-carbons, new synthetic hydraulic fluids and solvents.

They offer unsurpassed anti-friction properties, are tough, resilient, non-flammable, long wearing. They have a service temperature range from minus 110° F to plus 500° F.

Have you tested the complete line of Chemiseal packings for aircraft hydraulics? Write for further information and samples.

United States Gasket Company
Camden 1, New Jersey

†U.S.G. trademark
*du Pont trademark for its tetrafluoroethylene resin.

United States Gasket *Plastics Division*
OF THE GARLOCK PACKING COMPANY

Circle 131 on Reader Service Card

Useful Literature continued

HYDRAULIC RAMS . . . for mobile equipment and other applications are illustrated and described in a catalog issued by Spenborough Engineering Co. Ltd., Yorkshire, England. Line also includes hydraulic pumps and control valves for pressures up to 2000 psi.

Circle 251 on Reader Service Card

MOTOR BUYING INFORMATION . . . is given in Catalog 1027A published by General Electric Co., Schenectady, N. Y. Catalog presents information on a selected group of electric motors and is divided into six sections for convenient reference.

Circle 252 on Reader Service Card

BHEW

Custom-Built HYDRAULIC CYLINDERS

Made-to-order to meet specific design requirements for any application in any industry.

Compactness! Efficiency! Close Tolerances! Outstanding operational performance! You get them all in BHEW cylinders. They require minimum mounting space. There is no tooling charge for BHEW cylinders, built to meet *your* specifications and delivered on schedule.

BHEW cylinders are available in standard and special O.E.M. designs . . . single or double acting and telescopic; 1½" to 8" bore; strokes up to 156"; oil hydraulic service in 1,500 psi or 3,000 psi working pressure, pneumatic up to 150 psi; cup-type, ring-type or O-ring construction; choice of mounting.

1 Cylinder barrel and non-adjustable gland welded into one piece, eliminates joint, makes small O.D. in large single and double-acting hoist cylinders.

2 Accurately honed barrel.

3 Hard chrome-plated rod.

4 Flow regulating or pilot operative check valve in base, when required.

WRITE

for your copy of Hydraulic Cylinder Engineering Reference Data Manual. Can save you hours of time in specifying cylinders. 40 dimensioned basic designs for general and special purpose double acting cylinders.

BHEW **Benton Harbor Engineering Works, Inc.**
622 Langley Avenue, St. Joseph, Michigan

HYDRAULIC ACCUMULATORS . . . for service up to 3000 psi, are produced by the Pacific Division of Bendix Aviation Corp., North Hollywood, Calif. Catalog 115B gives complete engineering information on the line of cylindrical and spherical accumulators. Data included covers adiabatic and isothermal performance graphs and military standard envelopes.

Circle 253 on Reader Service Card

LUBRICANT TESTING MACHINES . . . are discussed in Bulletin 106 issued by Alpha Molykote Corp., Stamford, Conn. Operation of the machine is described and illustrated and complete specifications are given.

Circle 254 on Reader Service Card

HYDRAULIC PUMP-MOTORS . . . and rotary gear pumps are manufactured by Geo. D. Roper Corp., Rockford, Ill. Complete engineering information and specifications are given in Catalog 957.

Circle 255 on Reader Service Card

AIR CONTROL EQUIPMENT . . . is described and illustrated in Bulletin 75 released by Perfecting Service Co., Charlotte, N. C. Line includes air pressure regulators, filters, lubricators, couplings and rotary union seals.

Circle 256 on Reader Service Card

PRESSURE SWITCHES . . . for switching aircraft electrical circuits in response to pressure changes in gases and liquids are described in Bulletin AV-2004, issued by The Bristol Co., Waterbury, Conn. Both miniature and standard sized units are covered.

Circle 257 on Reader Service Card

INDUSTRIAL SOLENOIDS . . . manufactured by Detroit Coil Co., Ferndale, Mich., are described in a bulletin. Line includes shock absorbing and alternating types. Folder gives information on the units, materials used, and construction.

Circle 258 on Reader Service Card

TUBES & FITTINGS . . . for fluid power service are covered in Catalog No. 10, issued by Formrite Tube Co., Two Rivers, Wis. Line included formed tubes, aluminum ferrules, air hose assemblies and accessories.

Circle 259 on Reader Service Card

Continued on page 150

Circle 119 on Reader Service Card

specify standard UNBRAKO Dryseal-Thread Pressure Plugs

Use them in place of ordinary pipe plugs, or wherever liquids and gases must be contained under pressure. UNBRAKOs seal without compound. They are made of the same high strength alloy steels, have fully formed threads and the same internal wrenching feature as other UNBRAKO socket screws. Standard sizes—1/16" to 1¼"—are stocked by authorized industrial distributors. Ask your UNBRAKO supplier for Bulletin 883. Or write STANDARD PRESSED STEEL Co., Jenkintown 2, Pa.

STANDARD PRESSED STEEL CO.

UNBRAKO SOCKET SCREW DIVISION SPS JENKINTOWN PENNSYLVANIA

Circle 48 on Reader Service Card

INSTANT PRESSURE REGULATION

0 to 3000 PSI

Proven Superior in Comparative Tests

WITH THE Futurecraft HI/LO HAND LOADER

Futurecraft CORPORATION

1717 N. Chico Ave. • El Monte, Calif.

WRITE TODAY for complete details

GENERAL SPECIFICATIONS	
Port Size	¼" tube per AND 10056
Pressures	Operating—100-3000 psi Proof—6000 psi Burst—7500 psi Minimum
Flow	Exceeds any other loader available
Operating Temperatures	— 65° to + 250°F
Weight	2½ pounds

NOW . . . . . YOU CAN DIVIDE HYDRAULIC FORCE WITHOUT SACRIFICING PERFORMANCE ON YOUR MAIN OPERATION!

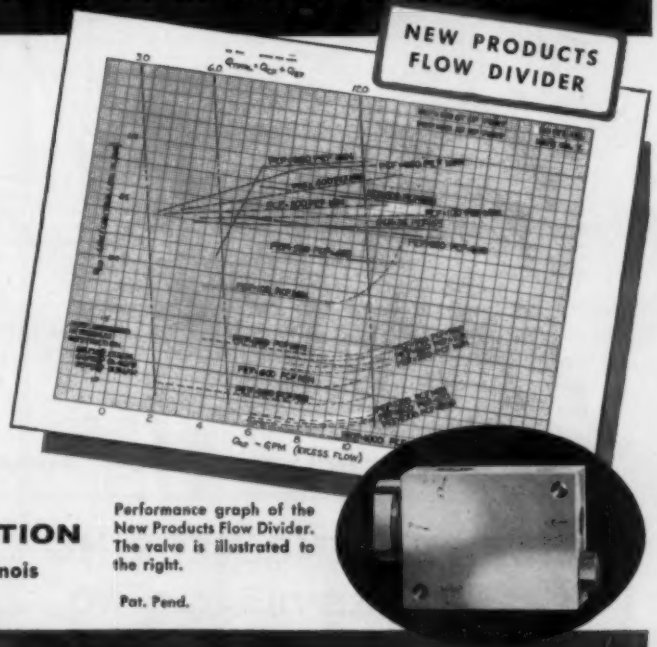
Now, for the first time, manufacturers operating equipment hydraulically have practically full control of the division of hydraulic force. The New Products Flow Divider will divide hydraulic force without sacrificing performance of your main operation because of secondary flow as with ordinary flow dividers.

This means, for instance, that on fork trucks no power in lifting will be sacrificed to power steering.

The Flow Divider is also adjustable with a screw driver to restrict the flow of the secondary in any desired proportion when the primary is in operation.

The New Products Flow Divider is simple, easy to install. It operates on low circulation pressure and it eliminates extra pumps. It is compact in design and quiet in operation and it is built to precision standards of the finest materials.

A new folder is available that describes its operation in detail and sums up its advantages. You should have it. It will be gladly sent on request.



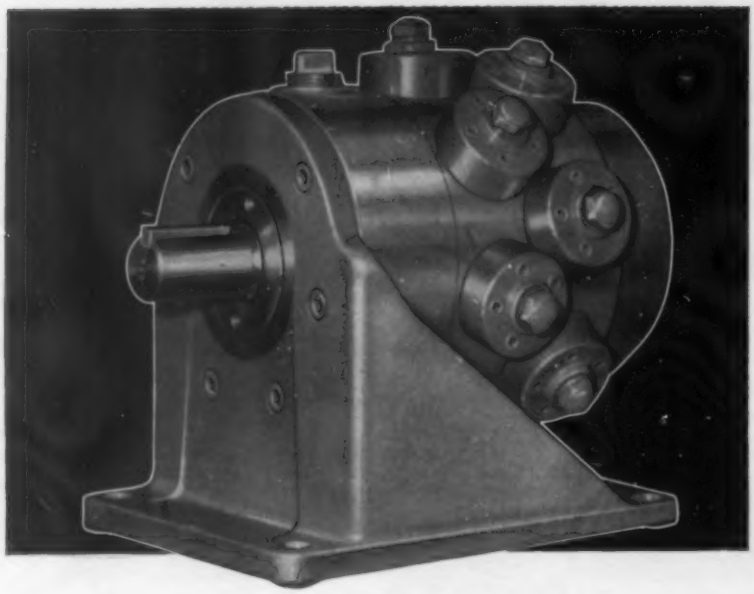
Performance graph of the New Products Flow Divider. The valve is illustrated to the right.

Pat. Pend.

NEW PRODUCTS CORPORATION

3636 Oakton Street Skokie, Illinois

Phone: ORchard 3-5873



for HIGH HORSEPOWER— HIGH PRESSURE service

This Series "C" SECO heavy duty pump is a rugged, revolutionary answer to high pressure, high horsepower requirements. It opens up new horizons in the use of oil hydraulic power.

Pressure is developed *within hollow pistons*—making it possible to generate pressures up to 10,000 PSI without loss of mechanical efficiency. Each piston assembly is completely surrounded by high pressure lubrication and literally *floats* in a hydrostatic film of oil during its pressure stroke. A specially designed oversize Timken bearing assembly insures minimum friction and maximum area of contact at points of piston actuation. *Fluid timed* ball check valves insure quiet and efficient operation at all pressures.

Series "C" SECO pumps are at present made in 2 models, with the following characteristics:

MODEL		C-11	C-5
MAXIMUM PRESSURE. SPOT RATING.....	PSI	5,000	10,000
MAXIMUM PRESSURE. CONTINUOUS RATING	PSI	4,000	6,000
DELIVERY AT MAXIMUM PRESSURE.....	GPM	10	5
SPEED	RPM	1170	1170
POWER INPUT AT MAXIMUM PRESSURE....	H.P.	35	38

If you are interested in high horsepower, high pressure hydraulic power, you should have complete information on these heavy-duty pumps. Use the Reader's Service Card.

SECO

SERIES "C" "HOLLOW PISTON" PUMPS

SIMPLEX ENGINEERING CO.
ZANESVILLE, OHIO

Circle 116 on Reader Service Card

Useful Literature / continued

GAGE ILLUMINATOR . . . with explosion-proof lamp unit is covered in Data Unit 300, issued by Jerguson Gage & Valve Co., Burlington, Mass. Unit is of the solid wedge lighting type with a simplified re-lamping procedure for maintenance.

Circle 260 on Reader Service Card

SEALANT . . . for pipe connections is described in bulletin released by American Sealants Co., Hartford, Conn. Material hardens between metal surfaces and forms a tough plastic securely holding threaded parts together.

Circle 261 on Reader Service Card

AIR CONTROL VALVES . . . poppet type design, manufactured by Galland-Henning, Nopak Div., Milwaukee, Wis. Complete engineering information, with illustrations, dimensional drawings and specifications, is given in Catalog 105.

Circle 262 on Reader Service Card

AIR COMPRESSOR . . . with integral diesel engine for independent operation, is described and illustrated in Bulletin 3207 released by Ingersoll-Rand, New York, N. Y. Unit is built for continuous full-load operation, and is available in five sizes with compressor cylinders to handle air at any commercial pressure.

Circle 263 on Reader Service Card

HOSE MAKE-UP CARD . . . for hanging on the wall, gives instructions with pictures of the two simple steps in assembling non-skive hose fittings to rubber-covered, wirebraid hose. Card is called Bulletin 4433B1 and is available from Tube & Hose Fittings Div., Parker Appliance Co., Cleveland.

Circle 264 on Reader Service Card

HYDRAULIC CONTROL VALVES . . . for service up to 5000 psi are listed in Bulletin 571, issued by C. B. Hunt & Son, Inc., Salem, Ohio. Construction and operation of each valve is described and illustrated, along with recommended applications.

Circle 265 on Reader Service Card

Circle 71 on Reader Service Card

SAFETY VALVE TEST STAND WITH "BUILT-IN" RELIABILITY

Completely reliable testing of safety valves is assured with the I. E. C. Test Stand. Four gauges give accurate readings, in the model illustrated, for pressures ranging between zero and 1000 pounds. Models are available for any ranges selected by the customer up to 10,000 pounds pressure. Adapter plates can be furnished to fit all sizes and types of safety valves. For complete information, please write for Bulletin 545.

Reliability of the Safety Valve Test Stand is guaranteed by the well known repeatability and accuracy of I.E.C. Gage Gards. They prevent the pressure being measured by each pressure gauge from exceeding its maximum.

INDUSTRIAL ENGINEERING CORPORATION

525 E. Woodbine, Louisville 8, Ky.

Now! BAR STOCK BRASS HOSE FITTINGS *That Give You Maximum Flow of Air and Water*

Service Mfg. & Supply Co. J.I.C. union type fittings are available with 37° flare adapters—elbows are 45°, 90°, in standard and long lengths. All fittings are wide aperture and machined from top quality bar stock. This gives you non-porous and maximum flow fittings.

J.I.C. Union type

Special Design—Designing and manufacturing special fittings to your prints is our specialty. In addition, our complete stock of non-porous wide aperture standard fittings will serve your normal needs.

Solid type

Short-Runs—Designing and manufacturing short-run orders is also a specialty of Service Mfg. & Supply Co. Fittings range from any length elbows to special "Y" fittings. Write today for catalog.

"Y" fittings—Standard stock or designed from your prints.

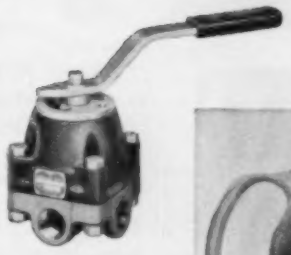
Jobber and agent inquiries invited.

Service Mfg. & Supply Co.

315 East State Fair Detroit, 3, Mich. TWinbrook 3-6565

For High Pressure (to 6000 P.S.I.) MANUAL WATER VALVES *that last*

Specify "SHEAR-SEAL" design



4-Way, Manipulator, Dual pressure and Shut-off Valves from ¼ to 1½" N.P.T.

Note the mirrorlike sealing surfaces on this Dual Pressure Valve rotor after 4 years of service.

On extrusion presses, die casting machines, rubber and plastic molding presses and on blowout preventers, they have performed without maintenance longer than any other type of valve.

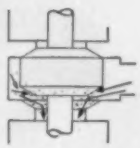
This LONG, MAINTENANCE-FREE SERVICE is possible because the metal-to-metal sealing surfaces are self-aligning and actually improve with use through continued lapping action. Sealing qualities do not diminish because a spring compensates for the wear.

DIRT CANNOT SCORE SEALS because flow is through "Shear-Seals," sealing surfaces remain in constant intimate contact.

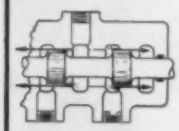
COMPLETE CONTROL OF YOUR CIRCUIT because "Shear-Seal" design is excellent for throttling. It permits opening to any desired degree of flow with smooth action and without fighting fluid pressure.

The "Shear-Seal" action eliminates line surges and the round tubular flow passages provide more flow and velocity capacity (up to 60 ft. per sec.) because they are unobstructed by spools or poppets.

This is why we don't use **SPOOL OR POPPET DESIGN**



Poppets score



Spools leak

Write for Bulletin W-5.

BARKSDALE VALVES

5125 Alcoa Avenue, Los Angeles 58, California

 Circle 112 on Reader Service Card

Circle 16 on Reader Service Card

Post Scripts of Industry

News about people, manufacturers and sales organizations

George N. Levesque
Brown & Sharpe Mfg. Co.

George N. Levesque, formerly director of research in the Machine Tool Division of **Brown & Sharpe Mfg. Co.,** Providence, has assumed duties as director of research on a company-wide basis. The company also announced the appointment of **Byron W. Moylan** to sales engineering representative for the Hydraulics Products Division.

Russell Dupuis
Vickers, Inc.

Russel Dupuis, formerly Omaha plant manager of **Vickers Inc.,** Detroit, has been made manufacturing manager, Machinery Hydraulics Div. Dupuis will manage production in the plants at Omaha, Waterbury, Conn., and El Segundo, Calif. **John Slack** succeeded Dupuis as plant manager at Omaha. **Thomas O. Brown** was made plant manager at Waterbury, and **A. W. Agnew** is the new plant manager at El Segundo.

Daniel T. Franklin
Hydralink Corp.

Columbia Steel & Shafting Company has purchased property and a plant building at Scottdale, Pa., where its **Summerill Tubing Division** will manufacture cold drawn stainless tubing. The Scottdale site comprises over four acres.

Daniel T. Franklin has been appointed chief engineer of **Hydralink Corp.,** Hazel Park, Mich. He had been chief production engineer of American Coupling Corp.

Foster E. Backus was promoted to midwest regional sales manager and **Robert C. Gaynor** to sales engineer of **Darling Valve and Manufacturing Company,** Williamsport, Pa. With offices at 1513 Jefferson Avenue, Toledo, Ohio, Backus will supervise sales activity in the 13-state area from western Pa. to the Dakotas and south to Kentucky. Gaynor, also at Toledo, will concentrate his efforts in Michigan and adjacent parts of Indiana and Ohio.

Fuller Company, Catasauqua, Pa., has opened a new plant in Compton, Calif. The plant manufacturers and stocks many Fuller components, and is expected to provide faster west coast service.

Minnesota Rubber and Gasket Co. has named **C. E. Deardorff** manager of its California sales office in Tarzana. Deardorff will be responsible for California area sales activities of all Minnesota Rubber divisions.

Joseph A. E. Hindman was named sales manager of **U. S. Gauge Division, American Machine and Metals, Inc.,** Sellersville, Pa. **Philip Johnston** became vice president and general manager, and **I. N. Becker** is the new vice president of operations for American Machine and Metals, Inc.

Continued on page 154

Circle 84 on Reader Service Card

New advance in...
GAUGE SAFETY

Another Marsh development... now "SAFE-CASE" gauge for those conditions where over-pressures of explosive force can occur.

Face well protected by solid metal wall; but, still more important, *entire back* is thin metal plate that opens out to exhaust any abnormal pressure. In testing, heavy blank cartridges, fired within back of case, did not even break crystal.

Use "Safecase" for your toughest services. It is standard in Marsh "Mastergauge"—the highest development in pressure gauges. Ask for facts.

MARSH INSTRUMENT CO.,
Sales affiliate of Jas. P. Marsh Corp.
Dept. 19, Skokie, Ill.
HOUSTON BRANCH PLANT: 1122 Rothwell St. Sect. 15, Houston, Texas
Marsh Instrument & Valve Co. (Canada) Ltd., 8407 103rd St., Edmonton, Alberta, Canada

Test Proves Safety
Explosive force of cartridge merely opens out safety-release back. Back is firmly attached to case and cannot be dislodged during a pressure blow-out.

MARSH GAUGES

LET US TAKE YOUR NOISE AND PULSATION PROBLEMS OFF YOUR HANDS

It is our engineering specialty to

STOP PULSATION
—from surges created by compressors, pumps, blowers and pressure reduction systems.

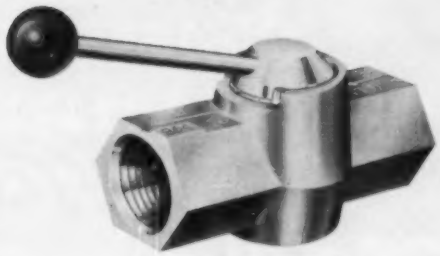
STOP NOISE
—from intake or discharge of air, steam or gas from engines, compressors and vacuum systems.

The Burgess-Manning Snubbing Principle, engineered to your specific problems, will provide noteworthy savings in operating and installation costs, increased production, reduced maintenance, improved public and employee relations and prevention of compensation claims.

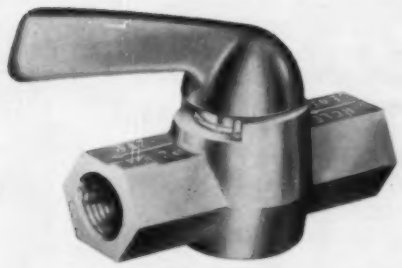
We invite you to present your problems for recommendations.

BURGESS-MANNING COMPANY
Sound Engineering 769 East Park Avenue, Libertyville, Illinois
Dallas, Texas

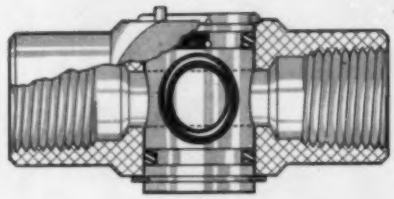
Circle Seal's



new



plug



valves

WITH ABSOLUTE LEAK-PROOF SHUTOFF AND "FINGERTIP" EASE CONTROL

Circle Seal now offers three new plug valves in pipe sizes ¼", ½" and ¾", with entirely new design features. Two of these features are dead-tight shutoff through the use of "O" ring flow seal and "O" rings at top and bottom to prevent external leakage. Opening and closing is effort free because of the use of a free-fitting cylindrical plug sealed with "O" rings. The unique design eliminates adjusting nuts and springs making the valve adjustment and maintenance free for long service life.

Wherever you use valves, specify Circle Seal—the finest quality.

For detailed engineering data, write

Circle Seal Products Co.
Incorporated
2181 East Foothill Boulevard, Pasadena, California

Circle 30 on Reader Service Card

Circle 1 on Reader Service Card

only the **Fall** Gets it All!

WHY be satisfied with only partial removal of dirt or other foreign accumulation from piston rods when you can—

Remove ALL the Dirt from Rod O.D. Stop Dirt Passing Through the Ring Joint with a

Fall "CJ" WIPER RING

The Ring with a Closed Joint!
SPRING LOADED
with Squeeze Grip Action

If you have a wiper ring problem write, wire or phone us.
All Fall Rings are covered by patents issued or patents pending.

ACE PRODUCTS CO.,
Toledo 1, Ohio
Phone Cherry 3-6513

You Can Depend on ACE Products—Established 1938!

Post Scripts of Industry continued

Robert A. Hamilton has been named assistant to the president of **Howell Electric Motors Co.,** Howell, Mich. He has an extensive industrial engineering background, including positions as general manager of two engineering companies.

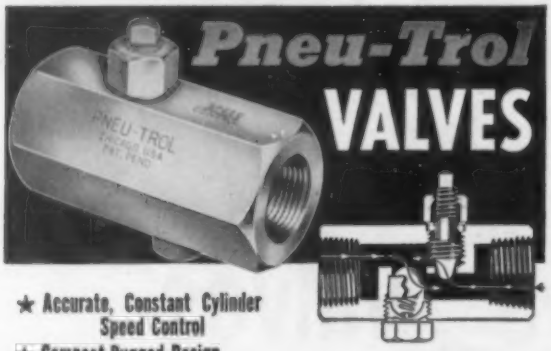
Robert A. Hamilton,
Howell Electric Motors Company

George J. Jacobs has joined **Resistoflex Corporation** as a sales engineer at the Cleveland office. Jacobs will represent the company in Northern Ohio, Southern Michigan, and in the Pittsburgh, Pa. area.

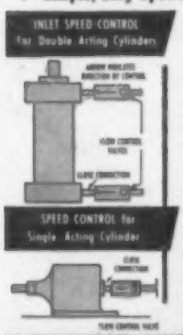
Appointment of **William Ohly** as distributor sales manager for Acro Division was announced by **Robertshaw-Fulton Controls Company.** Ohly will supervise sales of Acro switches to distributors.

George Ellison Ltd., Perry Barr, Birmingham, England, announced moving of their London office from Victoria St. to Ellison House, Connaught Place, London W.2.

Pneu-Trol VALVES



★ Accurate, Constant Cylinder Speed Control
★ Compact Rugged Design
★ Simple, Easy Speed Selection ★ For Air, Oil or Water Applications



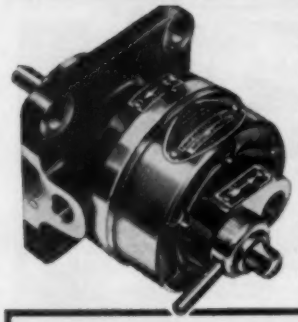
Pneu-Trol Speed Control Valves, are widely used in hundreds of control applications because they combine in a short, compact body, a tapered fine thread needle for extremely accurate air or oil flow control and a floating retro ball check, which permits full flow in the opposite direction. Retro ball floats in most sensitive position to its seat, requiring only a slight differential pressure to fully open or close it.

Needle design permits maximum flow capacity in the controlled direction. Metal to metal needle and ball seats insure long trouble-free service. Simple, practical "O" gland structure eliminates troublesome leaking. Valve bodies machined from hex brass or aluminum for 2000 psi working pressures; steel and stainless steel for 5000 psi. Made in 5 female pipe sizes—⅛" to ¾". ATTRACTIVE PRICES . . . IMMEDIATE DELIVERY.

Write for illustrated circular and prices.

Pneu-Trol DEVICES, INC.
1400 N. KEATING AVENUE • CHICAGO 51, ILL.

SAVERY ANNULAR PISTON PUMP



Infinitely variable from maximum output down to zero. Working pressures up to 1500 p.s.i. Fixed delivery models also available.

This compact rotary pump without Gears, Valves, Vanes or Springs is of unique design and simple in construction.

The pump has the following desirable characteristics:

- Volumetric efficiency as high as 99%
- Absolute positive action and steady uniform flow at slow speeds
- No aeration or turbulence of the fluid
- The path of the fluid through the pump is unidirectional and the internals are constantly swept by the fluid
- No idle pockets or passages to cause air locks or allow coagulation
- Completely self-lubricating, ensuring capacity to run for long periods without attention
- Leakproof

U. S. and CANADIAN AGENT
DAVIES BROS., GLADSTONE, NEW JERSEY

Thomas Savery Pumps Ltd., Birmingham, England

Circle 99 on Reader Service Card

Circle 109 on Reader Service Card

Sanford Evans, Jr., has been appointed western regional manager for the sales division of **Dalmo Victor Co.** With headquarters in Los Angeles, Evans will have charge of all company technical sales activities from the Pacific Coast to Oklahoma City.

Robert W. Phillips has been appointed chief engineer of synthetics and plastics in the research and development division of **Flexonics Corp.,** Maywood, Ill. He was also elected to the company executive council. Phillips was formerly chief engineer of the Flex-O-Tube Division. He will maintain headquarters and laboratory facilities at the Inkster, Mich. plant. The company also announced the ap-

Robert W. Phillips
Flexonics Corp.

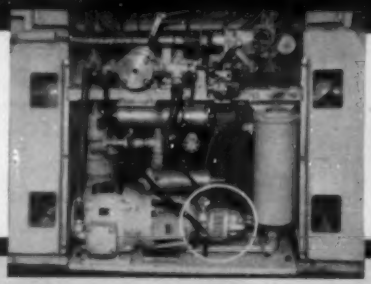
pointment of **Yaco, S. A.,** Buenos Aires, to manufacture synthetic and plastic hose assemblies under the Flex-O-Tube trade mark. The agreement with Yaco does not affect South American agents for Flexon metal products. **Robert F. Barge** has been made sales engineer for the Lake Erie and St. Lawrence Area with headquarters in Cleveland. Barge is responsible for sales and service engineering to customers, distributors and agents.

Franklin C. Wolfe Co., Division of Parker Appliance Co., announced the completion of a 24,000 sq ft addition to their Culver City, Calif. plant. The new unit will house metal-working equipment formerly used by the Mathewson Corp., a company recently purchased and merged with Wolfe.

Continued on next page

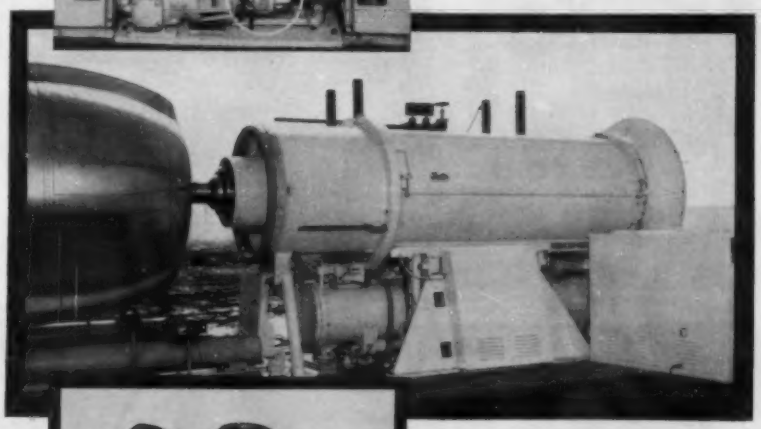
TWA COUNTS ON ROPER DEPENDABILITY

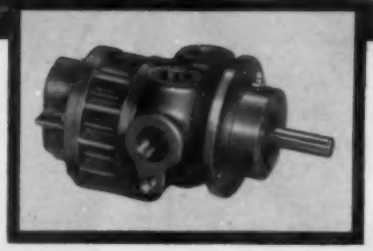
for Efficient Operation of Engine Test Stand



NERVE CENTER OF THE UNIT

Oil used as the power absorption medium in this dynamometer is supplied to the inlet control valve by a Roper Series F Pump. Four other Roper pumps are integral for pressure lubrication and hydraulic actuation of this unit.





ROPER SERIES F PUMP

1-300 GPM • TO 300 PSI

This 5000 HP Absorption Dynamometer, one of five specially designed for TWA by Clayton Mfg. Co., El Monte, California, is the newest concept of aircraft engine testing and run-in. Its use is based on a principle of power absorption, and thus replaces the club propeller used on conventional test stands. The unit is proved to be a quicker, more accurate means of testing than has been previously available. Standard Roper Series F Pumps were specified by Clayton for inclusion in the nerve center of the unit. It is another example where design men call upon Roper because they know of Roper dependability.

Send for Catalog or See it in Sweets

GEO. D. ROPER CORPORATION
707 Blackhawk Park Avenue
Rockford, Illinois

ROPER Rotary Pumps

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Circle 128 on Reader Service Card

TRUE-TRACE

MACHINE TOOL CONTROLS

Send for new 24 page catalogue

Greater production and increased profits thru 1, 2 and 3 slide control hydraulic tracers and numerical controls.

TRUE-TRACE SALES CORP.

El Monte 2, Calif.

Post Scripts of Industry

continued

Sinclair-Collins Valve Company and **Valvair Corporation** announced the construction of a plant addition to house the companies' general engineering, methods engineering departments, and the development engineering section. Increased sales volume and product research and development programs created the need for the 6000 sq. ft. addition.

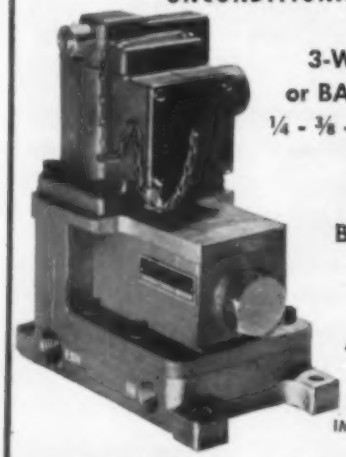
E. D. Sweetland Co., San Francisco and Los Angeles, announces the appointment of **R. R. Phillips** as general manager of the Los Angeles office to handle the sales of air and hydraulic equipment. For the past eight years, he has been a management consultant working with west coast industry.

Snyder Tool & Engineering Company, Detroit, named **Leo P. Gajda** vice president—engineering, and **Bruce M. Regan** vice president—manufacturing. Gajda had been director of engineering since 1951.

Leo P. Gajda
Snyder Tool & Engineering Co.

Solenoid Operated AIR VALVES
conform to all J.I.C. Standards

Stop Your Solenoid Troubles with AV VALVES Designed & Engineered for Many, Many Millions of Trouble Free Operations & Backed by 1 Year UNCONDITIONAL GUARANTEE



3-WAY IN-LINE
or BASE MOUNTED
¼ - ⅜ - ½ - ¾ - 1 - 1¼

• • • •

4-WAY
BASE MOUNTED
¼ - ⅜ - ½ - ¾

COMPLETE LINE OF AIR CONTROL VALVES

STOCKING REPRESENTATIVES IN IMPORTANT INDUSTRIAL CENTERS

Write for Bulletin and New Low Prices

AUTOMATIC VALVE CO.
37419 GRAND RIVER AVE., FARMINGTON, MICH.

THE ORIGINAL
MONOPAK—CARTRIDGE

A complete packing unit for hydraulic or pneumatic rods or cylinders.

**Detailed literature on request.*

- Easily installed or replaced.
- Needs no adjusting.
- Reduces initial machining expense.
- Longer service life.
- Includes "Seal-Guard" rod wiper.
- Low friction coefficient.
- Shock and burst proof.
- Cuts machine down-time.

HYDRAULIC ACCESSORIES CO.
24301 Hoover Rd. Van Dyke, Mich.

Circle 13 on Reader Service Card

Circle 69 on Reader Service Card

John D. MacGuffin is the new sales manager of **Briggs Filtration Co.**, division of Bowser, Inc., Washington, D. C., succeeding H. K. Woodward. Woodward became administrator of the eastern region of Bowser, Inc., with headquarters in New York City.

George E. Harris & Co., Inc., 3241 East Douglas, Wichita, Kansas was appointed by **Eastern Aircraft Products Corp.**, Orange, N. J. to represent their products in the Mid- and Northwest. **Autry, Rushin and Dane, Inc.**, 43 Irby Ave., N. W., Atlanta, now represents Eastern in the South.

Robert A. Erskine has been appointed chief engineer, industrial department, **Vickers, Inc.**, Detroit. Erskine was formerly staff assistant to the vice president and

Robert A. Erskine
Vickers Inc.

Carl E. Gunther
Vickers Inc.

director of engineering. **Carl E. Gunther** was named chief engineer, marine and ordnance dept. Gunther will be located at the Waterbury, Conn. plant.

Continued on next page

positive, automatic PRESSURE CONTROL
you can depend on

FULFLO piston type, oil-relief hydraulic by-pass valves are designed and built so you can install 'em, then forget 'em! They are quiet, non-chattering because of shear-closing action. Low price and high quality, make Fulflo Valves a wise choice for O.E.M. use . . . replacement too! Available with "O" Ring or Gasket Seal.

- **Standard and Flanged models**
- **Just 6 springs for pressures to 500#**
- **Cast iron or brass bodies**
- **Brass, steel or stainless pistons**
- **Pipe sizes to 2½"**
- **SPECIALS to your requirements**

FULFLO

WRITE FOR "Fulflo Valves Mechanical Data Book", free helpful reference.

THE FULFLO SPECIALTIES CO., INC.
415 Fancy Ave., Blanchester, Ohio

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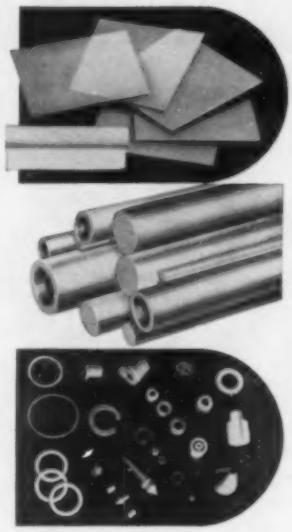
Circle 113 on Reader Service Card

START WITH THE BEST!

Are you up to date
on Fluorocarbon Stock and Parts?

SHAMBAN TEFLON*
KEL-F, CALIFILM
Tape • Sheet • Rod • Tubing •
Custom Molded or Machined Parts



Exacting specifications? Meet or exceed 'em with SHAMBAN! Whatever your requirements in Teflon, Kel-F and Fluorothene—SHAMBAN *can supply them!*

Back-up Rings...O-rings...Piston rings... Scraper rings...Valve packings...Vee-seals... Tape...Spaghetti...Insulators...Film... Grommets...Glass fabrics...Fiber felt...Extruded shapes...Uncured tape...Filled Teflon ...Bondable film...Cementable sheet and tape.

Throughout industry, SHAMBAN's remarkable Qualities are pointing ways to *improve* existing products—providing opportunities to create *new* products and applications! Write, wire or phone for complete data on how SHAMBAN can help you.

**du Pont Trademark*

Use the BEST *in Fluorocarbon Products, Specify* SHAMBAN!

KELON

W. S. SHAMBAN & CO.
11617 W. Jefferson Blvd., Culver City, California
Meyer Road, Fort Wayne, Indiana

Post Scripts of Industry
continued

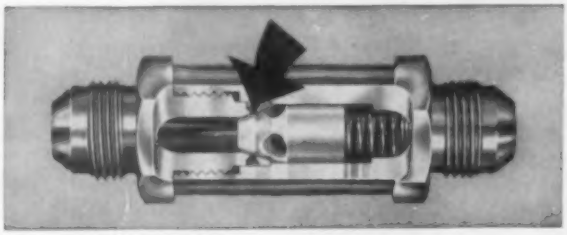
James S. Anderson has been elected vice president in charge of sales for Tubular Products Division of **Babcock & Wilcox Co.** Anderson will continue to make his headquarters in Beaver Falls,

James S. Anderson
Tubular Products Division
Babcock & Wilcox Co.

Pa. The company announced that **J. Y. McCandless** was made manager of the Syracuse district sales office of the Tubular Products Division.

Simple, Secure . . . Leak-Tight!

The **FLEXIBLE SEAL SEAT***



Responsive action of the soft O-ring seal provides absolute leak-tightness. Instantly compresses to seal internal and external pressures. Draws harmlessly around dirt particles. No costly precision parts; no extra end seals. Stocked in 6 standard Dryseal pipe and JIC tube sizes; 12 connection combinations. Write for data sheet.

KEPNER PRODUCTS COMPANY
7321 West 59th Street • Summit, Illinois

Kep-O-seal

HYDRAULIC & PNEUMATIC
CHECK VALVES
* PATENT APPLIED FOR

What a sight!

CENTURY'S
All-new Oil Level Sight Gage

- No Easier Installation Ever Designed
- Better Visibility at any Height
- Leak-proof—No Dripping
- Streamlined Modern Appearance
- Important Savings in COST
- Available NOW From STOCK

Send for new catalog containing dimensional information on hydraulic reservoirs and complete line of power unit accessories.

CENTURY HYDRAULICS, INC.
7703 LYNDON AVE. • DETROIT 38, MICHIGAN
Telephone Diamond 1-3797

Circle 108 on Reader Service Card
Circle 27 on Reader Service Card

Two appointments in the sales department of **Fulton Sylphon Division** of **Robertshaw-Fulton Controls Co.,** Knoxville, Tenn., were announced. **Marvin G. Calhoun** was named supervisor of the bellows sales division, and **J. H. Fielden** was appointed applications engineer.

Barksdale Valves announced that **Dick Nash** has joined their Hartford office. He will sell and service the company's products in southern Conn. and western Mass. They also announced the expansion of their Philadelphia branch location at 1468 Old York Road, Abington, Pa. **M. Thomas Robbins** will manage the York-Harrisburg area, southern Philadelphia and Delaware.

John B. Alger has been named sales representative for the industrial distributor division of **Weatherhead Company,** Fort Wayne. He will cover Georgia, Alabama, Florida, Louisiana, and Mississippi. **Edwin K. Toner,** Philadelphia, has been appointed sales representative covering Penn., and New Jersey.

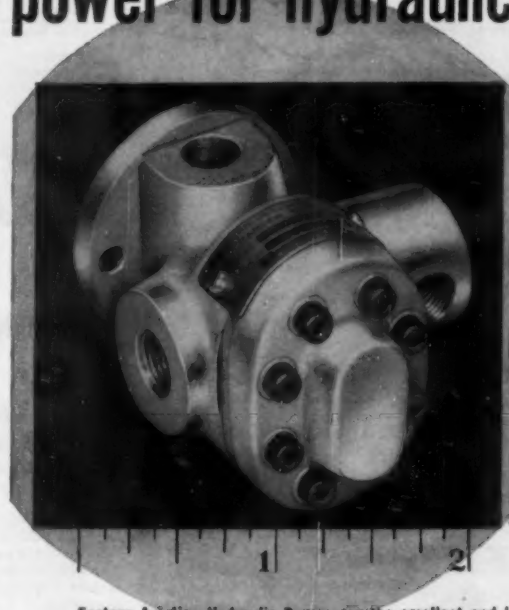
The stockholders of **Greer Hydraulics, Inc.,** Jamaica, N.Y. elected **David Fromson,** the company's secretary and counsel, a member of the board of directors.

Baboo Ram (Bob) Teree
Greer Hydraulics Inc.

They also announced the election of **Baboo Ram (Bob) Teree** to vice-president in charge of engineering and manufacturing. Teree was formerly chief engineer and manager of engineering and manufacturing.

Continued on page 161

power for hydraulic systems



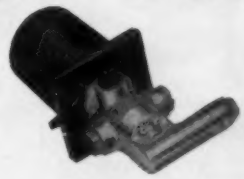
comes in small packages

Eastern Aviation Hydraulic Pumps are the smallest and lightest line of pumps ever made. They supply as much as one gallon of fluid per minute against pressures as high as 2000 PSI.

The 1700 Series of high speed gear pumps have theoretical displacements varying from .0091 to .1089 cubic inches per revolution. This series of pumps can be close-coupled directly to various electric motors. They are made in many configurations with and without integral bypasses. A variety of bearing combinations handle different types of fluids and operating pressures.

Eastern engineers can adapt and design hydraulic pumps to meet your specifications. On your next project, contact Eastern for engineering help that really helps.

Eastern 1700 SERIES PUMPS



1733-HBU-249

1731-LCU-205

1781-HBV-255

1700 SERIES PUMP

See you at Wescon Show Booth 3216

Send for Aviation Bulletin 340

Eastern INDUSTRIES, INC.

100 SKIFF ST. • HAMDEN, CONN.

Circle 39 on Reader Service Card

Palley's SAVE YOU UP TO 85%

on HYDRAULIC CYLINDERS - VALVES - PUMPS - PARTS, etc. . .

OVER 10 YEARS EXPERIENCE In filling the needs of Aircraft and Heavy Industry led to the development of our own line of outstanding INDUSTRIAL HYDRAULIC CYLINDERS and supplies. We also carry one of the largest stocks of GENUINE GOV'T SURPLUS CYLINDERS, VALVES, PUMPS, MOTORS and Accessories. What we cannot supply we will CUSTOM MANUFACTURE to YOUR specifications.

NEW Palley HYDRAULIC CYLINDERS

All are Double Action with rugged steel construction throughout. Made to stand pressures up to 1500 PSI and 3000 PSI. Utilizes standard 'O' rings in all models and has leather back-up rings in the 3000 PSI types.

PART NO.	BORE	STROKE	SHAFT	P.S.I.	PRICE
P3-4-15E	3"	4"	1-1/8"	1500	$34.25
P-6-15E	3"	6"	1-1/8"	1500	36.75
P3-12-15E	3"	12"	1-1/8"	1500	44.75
P4-5-15E	4"	5"	1-1/8"	1500	39.50
P48-15E	4"	8"	1-1/8"	1500	45.75
P4-5-30E	4"	5"	1-1/2"	3000	55.25
P4-8-30E	4"	8"	1-1/2"	3000	61.50
P4-12-30E	4"	12"	1-1/2"	3000	69.75
P5-12-30-1	5"	12"	2"	3000	85.00
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SPECIAL GOV'T SURPLUS HYDRAULICS

40,000 LB. THRUST CYLINDER
A GOV'T SURPLUS BARGAIN! Produces up to 40,000 lb. thrust with a 3000 PSI line pressure. May also be used as a low pressure air cylinder. Has 4" bore, 18" stroke. 30½" long. Navy overhauled– LIKE NEW – **49.95**

VICKERS PISTON TYPE PUMPS
Made to top Aircraft specifications. RPM given below is recommended for constant speed.
PF9-713-20BCE – Delivers 5.3 GPM at 1000 PSI at 3000 RPM – USED $20.00
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VICKERS HYDRAULIC MOTOR
MF9-713-25BCF–Operates on 8.25 GPM at 1000 PSI at 3750 RPM–USED $22.50

2 GPM STRATO POWER PUMP

Positive displacement type. Capacity of 2 GPM at 1400 PSI. Displaces .450 cu. in. per revolution at 3750 RPM in either direction of rotation. Intermittent maximum RPM – 4500. Has a built-in, variable flow control valve in head. Piston type. 1 inch internal pipe ports. **New 27.50**

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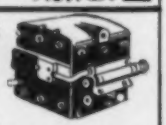

Self-contained, constant torque at all speeds with variable volume, reversible piston pump which supplies hydraulic motor. Has 2 H.P. automatic dash pot for smooth pressure control. Power output is 0 to 1/3 of the input RPM in both directions of rotation. Input RPM is 1800 continuous and up to 4000 intermittent. This is an excellent unit for the operation of Lathes, Duplicator Set-ups, Conveyors, Drives of all types, etc. **ONLY 49.50**

INPUT & TAKE-OFF PLATE ASSEMBLIES
These units permit the adaptation of a pulley input and take-off for the transmission above. They have high speed bearings and 1/2" diameter, shaft with keyway. Easily installed. **10.50 EACH**

4-INCH SPLINE SHAFTS Made to fit the input and take-off shafts of the transmisson above. Permits use of gear or pulley drives. **1.25 EA.**

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ALLEN 'TRU-ROUND' Dryseal Pipe Plugs
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standard sizes from 1/16" to 1-1/4"

Here's the dependable, metal-to-metal seal you need for hydraulic systems . . . for transmission, control, and automated mechanisms where pressures run high. The N.P.T.F. threads of Allen ⬡ Dryseal Pipe Plugs are smooth, burnished, and burr-free — do their job without any help from sealing compounds. Allen's unique "pressur-forming" process assures the highest degree of precision threading and dimensional accuracy. What's more, Allen ⬡ Dryseals are precisely round at root, pitch and crest, with taper held to extremely close tolerances.

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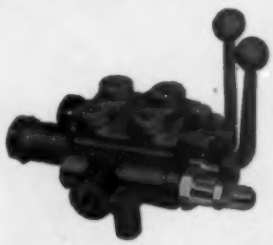
GRESEN HYDRAULICS

A Two Spool Directional Control With Float



FEATURES: Detent in Float Position—Self Centering From Power Positions—Fully Balanced—Relief Valve Has Replaceable Hardened Seat—Tripod Mounting Feet—Smooth Positive Throttling Action —Hardened and Chrome Plated Spools.

SPECIFICATIONS: Capacity 20 GPM (at 20 Ft/seconds)—Maximum Pressure 1500 PSI—Parallel Application—Shipping Weight 22-1/2 Lbs.

Write for literature

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628 Colfax Ave. N. Dept. H-77 Minneapolis 11, Minn.

Post Scripts of Industry
continued

Dynex, Inc., Pewaukee, Wis. has named distributors in the South and Southwest to handle their products. New distributors are: **Andress, Mouat & Assoc.,** 538 American Life Bldg., Birmingham; **Gondas Corp.,** 2140 N. Miami Ave., Miami; **Scott Industrial Equipment Co.,** 6703 Manslick Rd., Louisville; **Sintes Sales Engineers,** 332 S. Diamond St., New Orleans; **Ellis Akin Engineering Co.,** 2934 Cherry St., Kansas City, Mo., and 305 W. 6th St., Tulsa; **J. E. Dilworth Co.,** 730 S. 3rd St., Memphis; and **Womack Machine Supply Co.,** Shea Rd., Dallas.

Purolator Products, Inc., Rahway, N.J. announced the appointment of **John W. Puth** as advertising manager. He will assist merchandising manager Howard J. Hopkins in the supervision of all Purolator advertising, public relations and sales promotion work.

John S. Puth
Purolator Products, Inc.

Automatic Switch Co., Florham Park, N. J. appointed **Donald T. Arundel** to their sales engineering team in the New York City area. They have also appointed three new distributors. They are: **Lakeland Engineering Equipment Co.,** 116 Third Ave., Minneapolis; **Leinart Engineering Co.,** 412 E. Fifth Ave., Knoxville, Tenn.; and **Evansville Supply Co.,** 800 Pennsylvania St., Evansville, Ind.

Continued on next page

An important announcement . . .

AIRCRAFT HYDRAULIC DESIGN

• **The first book** dealing with hydraulic component and system design for high-speed piloted aircraft and missiles, has been written by a leading aircraft engineer. Developed from practical and theoretical material, the book develops many basic equations including those relating pressure gradient, flow-path dimensions, flow rate, velocity, fluid density, and viscosity.

• **Design of system components** including actuators, valves, pumps, accumulators, transmission lines and seals is discussed.

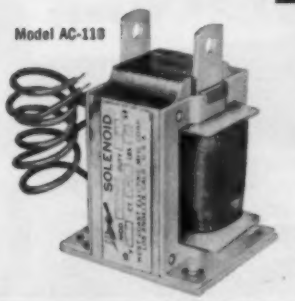
• **Hydraulic servo systems** are diagrammed and the transfer functions developed. Fundamentals of transient analysis technique and frequency response method of servo testing are given. The chapter on high temperature hydraulics outlines present progress in fluids, seals, springs, metals, and other critical components, and indicates future developments.

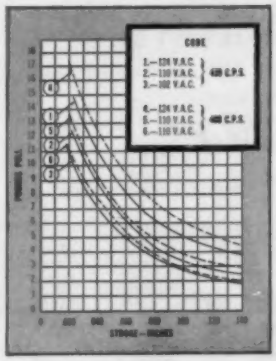
by GEORGE R. KELLER
Group Leader,
Flight Control Engineering Dept.
Autonetics, A Division of
North American Aviation

$4.50
10 or more $4.00 per copy
Limited Edition

THE INDUSTRIAL PUBLISHING CORP.
812 HURON ROAD
CLEVELAND 15 OHIO

A WesCo special: 400 cycle HI-TEMP solenoid!





WesCo's specially designed 400 cycle solenoid may help you solve your problem. Proven on latest military aircraft and other selective high temperature applications. Model shown is continuous duty, weighs 1 pound, tested to 600°F. Mounting furnished to meet your needs. Remember, when you need a solenoid, think of WesCo.

AC Industrial Solenoids—full line. Write for brochure.

DC Aircraft Solenoids—send specifications or write for catalog.

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LOS ANGELES 61, CALIFORNIA • PLymouth 5-1138

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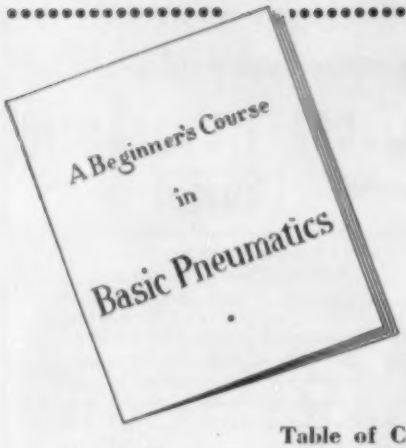

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First printed in July 1954, 5000 copies of this popular booklet were bought by more than 800 companies and individuals. A second printing completed in March 1957 makes this course available to you.

$1.50 per copy

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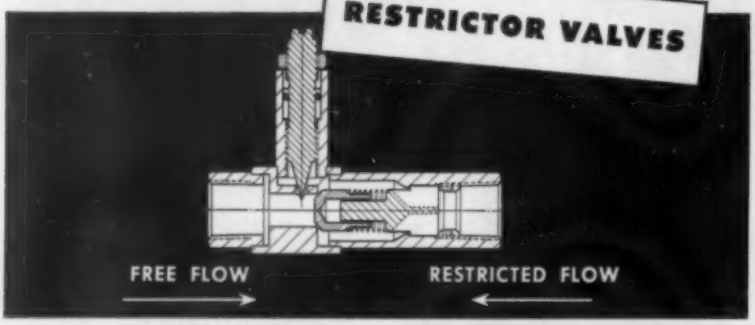
DEPENDABLE



- **CAN'T STICK OPEN due to dirt in oil**
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Relief Valves • Check Valves • Restrictor Valves
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Pressure Compensated Flow Regulators

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Member Of Fluid Power Association

Post Scripts of Industry
continued

Victor F. Kent was appointed assistant advertising manager in charge of sales promotion at **Aeroquip Corp.**, Jackson, Michigan. He has charge of direct mail advertising, shows, slide films, motion pictures, and distributor cooperative advertising.

E. W. Lapp has been appointed purchasing agent for **Dynex, Inc.**, Milwaukee, Wis., by Dynex president Phillip G. Brumder. Lapp was formerly project engineer supervisor and purchasing agent for the M and W Gear Co.

Republic Mfg. Co., Cleveland, announced the appointment of **Les Henderson** as vice president in charge of sales. Henderson

Les Henderson
Republic Mfg. Co.

was formerly general sales manager of the special products division of Weatherhead Co.

Power Jacks Ltd., London, England, are adding to their sales force and moving their sales office from Valetta Rd., Acton, to 353 Uxbridge Rd., London W.3.

Automatic Switch Company, Florham Park, N. J., has appointed **Raymond L. Walter** field engineer for the northern New Jersey and western Conn. territory. They also announced the appointment of **Ace Supply Company**, 321 W. Josephine St., San Antonio, as an authorized distributor of their products.

Joseph R. Smith has been named western district manager for **Flick-Reedy Corp.**, Melrose Park, Ill. He will be responsible for sales in all states west of the Mississippi for Miller Fluid Power Div., and Tru-Seal Div.

Joseph R. Smith
Flick-Reedy Corp.

William S. Ernest was appointed production research engineer for **Brooks Rotameter Co.**, Lansdale, Pa. He was formerly production engineer at U.S. Gauge Company.

Hydraulic Accessories Co., Van Dyke, Mich. announced the appointment of **Thomas W. King** as national sales manager.

Thomas W. King
Hydraulic Accessories Co.

The new sales organization will handle the company's metal rod wipers and their hydraulic valves.

Dycon Ltd. has been formed to specialize in the sale of hydraulic equipment, and will continue association with **John Spotton Co. Ltd.** Offices for both companies are at 25 Carson St., Toronto, Ontario, Canada.

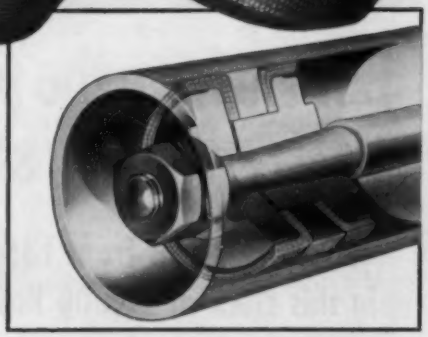
Continued on next page

PUMCUP ADVANTAGES

now yours for

• HYDRAULIC CONTROLS
• AIR CYLINDERS
• RECIPROCATING PUMPS

Two common Pumcup types: conventional and 45° bevel type . . . available in a complete range of sizes and texture-engineered compositions.



Cutaway view of typical Pumcup installation resulting in prolonged high efficiency.

TAKE it from experienced users, Darcova Pumcups offer payoff advantages that can't be equalled! For example, they last many times as long as ordinary piston packing..and they *hold peak efficiency* from start to finish. Because of the resulting production and maintenance economies, plant after plant is standardizing on Pumcups.

Improved application of the cup principle does the trick. And Darcova Pumcups are *texture-engineered* in *a range of compositions* to meet most temperature-pressure-fluid conditions. And they are available in sizes and types exactly right for your particular equipment.

It will pay you to get *all* the facts. Just ask for Pumcup Bulletin No. 5503.

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Williamsport 15, Pa.

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THE ORIGINAL COMPOSITION CUP
TRADE MARK
PUMCUPS

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"Bet we have the pumps you need right in stock!"

Take your pick from 135 different varieties in this stock of 20,000 Brown & Sharpe pumps

Be sure to check Brown & Sharpe first when you're looking for the "right" pump. We make many types of Rotary Geared, Automatic Reversing Vane, and Motor Driven Centrifugal Pumps . . . stock at least 20,000. There's a good chance you'll find the pumps you want here, right away, at prices you want to pay.

You will find too, that Brown & Sharpe can often create *special* pumps at surprisingly low cost, based on modified stock pumps and parts. This is especially true in the case of special mountings, units comprising two or more pumps, and pumps with special internal construction.

SEND FOR HELPFUL CATALOG AND PUMP ANALYSIS FORMS

Brown & Sharpe's Pump Catalog has a unique engineering section that should be a big help to you if you are involved in specifying and ordering pumps. It also contains handy Pump Analysis Forms which you can fill out and return for complete quotations and recommendations on your requirements. Brown & Sharpe Mfg. Co., Providence, R. I.

Brown & Sharpe B·S

PUMPS, MILLING, GRINDING AND SCREW MACHINES, CUTTERS, MACHINE TOOL ACCESSORIES, PRECISION TOOLS

Post Scripts of Industry
continued

Double A Products Co., Manchester, Mich., has announced the appointment of **J. T. Sudduth & Co. Inc.,** Birmingham, Alabama as sales representatives. They will represent Double A's complete line in Tennessee and Alabama.

Morgan C. Plummer has been appointed supervisor of Pydraul sales for the organic chemicals division, **Monsanto Chemical Co.,** St. Louis. He was sales engineer in the functional fluids section prior to his appointment.

Turchan Follower Machine Co. has moved from Detroit to a new plant at 26950 Van Born Rd., Inkster, Mich.

Cuno Engineering Corp., Meridan, Conn. appointed **Walter J. Holder** manager of its Micro-Klean Filter Division. He has headquarters in Meriden.

Walter J. Holder
Cuno Engineering Corp.

Vincent R. Barrord has been appointed manager of welded tubing development sales for **Babcock & Wilcox Company's** Tubular Products Division, Beaver Falls, Pa. Barrord is responsible for the development of new product applications and new outlets for existing applications. His office is at the division's welded tube plant in Alliance, Ohio.

THE MARKET PLACE

When replying to a box number in the Market Place, address your letter to Applied Hydraulics, 812 Huron Road, Cleveland 15, Ohio. Attention: Box No.

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To handle complete line of Component Hydraulic Filters for pressures of 5000 psi and flows from 15-90 gpm. Filters have special designed head—no bolts, removable in 10 seconds. Specification sheets available.

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Test Equipment Division
1 John Street
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Attention: Mr. L. B. Haberman, General Manager

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DISTRICT MANAGER WANTED

A prominent manufacturer in the hydraulic and pneumatic field wishes to establish its own regional sales office in the Los Angeles area. If you think you have the qualifications to manage such an assignment, please write with the guarantee that your inquiry will be treated in confidence. For consideration you must send full details in first letter. This is a rare opportunity. Write to Box No. 1757 APPLIED HYDRAULICS.

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NO OTHER RING offers
THE 3 ADVANTAGES
. . found in the AUTO-DIESEL GAPLESS Piston Ring

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2. LOWERS THE COST OF COMPRESSED AIR.
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The Auto-Diesel GAPLESS Piston Ring with the patented insert is a new development by Auto-Diesel Engineers and offers advantages not found in other rings. It can be adapted for high temperatures by changing the inserts. There are many applications—can be made a contracting ring for sealing shafts, bearings or replacing packing, etc.

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SEALED AGAINST. . BLOW BYS

This is a very important feature because blow bys will always lower compression. Can be used as original or replacement in pneumatic operated industrial equipment and for normal pressure hydraulic. You are assured longer life. Made in sizes from 2" and up. It will pay to investigate.

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Engineer must have a minimum of five years' experience with a degree in Mechanical or Engineering Mechanics. Hydraulics experience, preferably in Aircraft, concerned with product design experience, data analysis or product improvement desirable.

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Circle 5 on Reader Service Card

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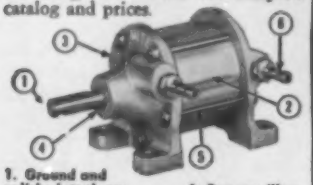
Low Cost... Compact... Powerful... Rugged

AIR-MITE Cylinders—made in single or double acting series—in 4 mounting types, are high quality cylinders at a low price. Simple, rugged design and compact construction give them long life, permit easy mounting on jigs, fixtures, tools, or machines. Used wherever power holding, pushing, pulling or lifting is required, AIR-MITE cylinders will meet your most exacting standards of dependability and long life. Write for complete catalog and prices.



1. Ground and polished steel ram
2. Brass, true-bore cylinders
3. High strength aluminum alloy cylinder heads
4. Bronze oilless ram bushing
5. Five steel tie rods
6. Brass hose stems

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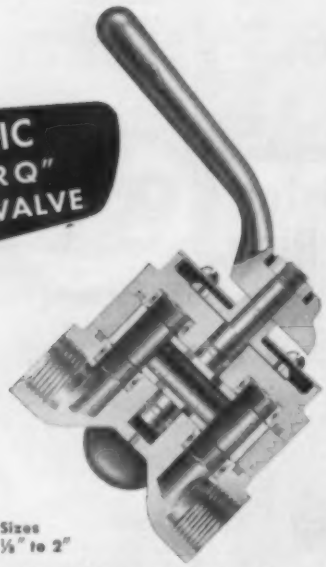
REPUBLIC "LO-TORQ" SELECTOR VALVE



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- Low turning torque
- Panel mounting
- Semi-steel, bronze, aluminum alloy
- Zero leakage
- 3 types of portings
- Sizes ⅛" to 2"

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Happy Vacation Days To Users Of Mayson Hose Swivels.

MAYSON MFG. CO.

4332 HORATIO STREET • DETROIT 10, MICH.

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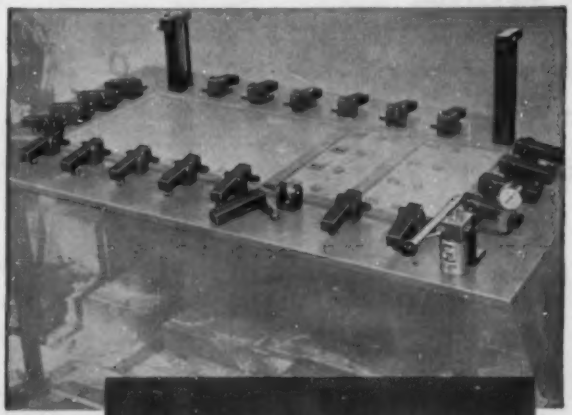
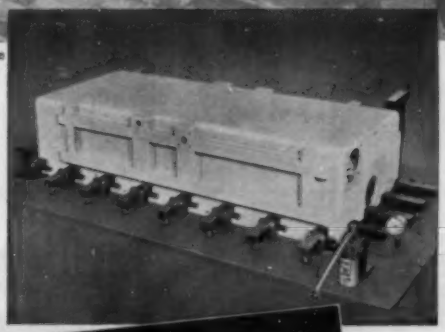


Sump Pressure Test Rig.



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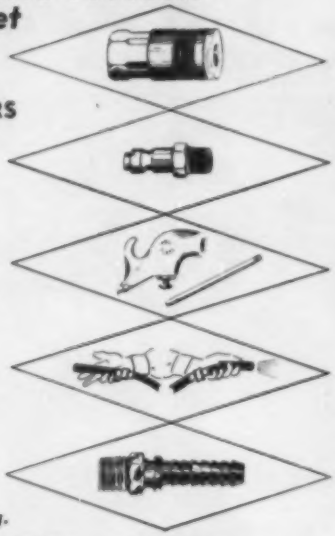

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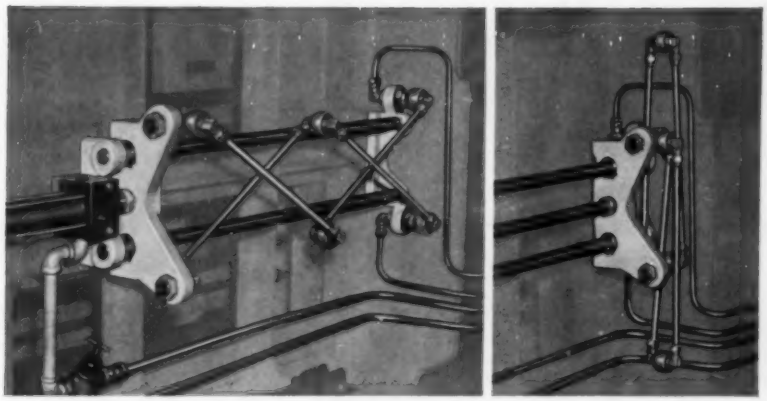

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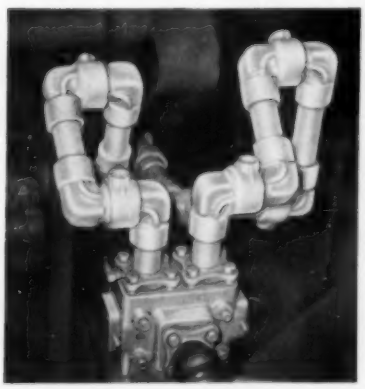

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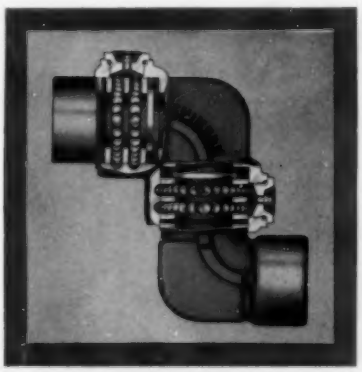

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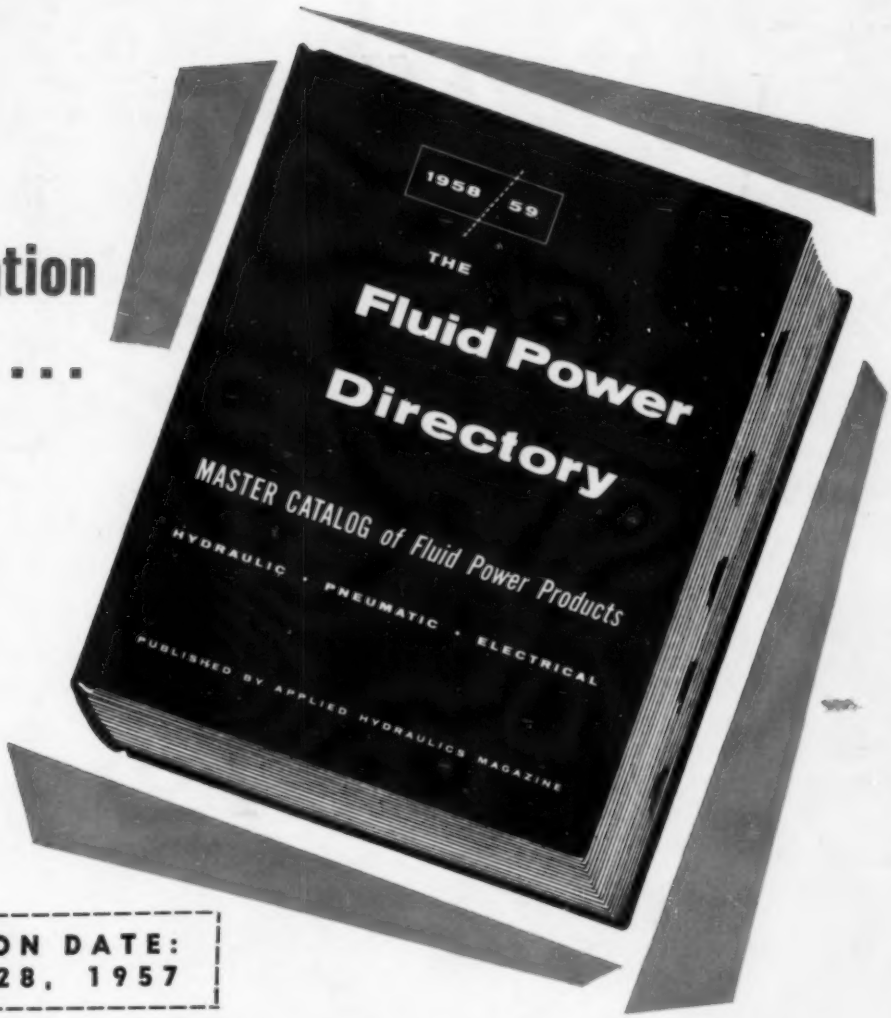

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